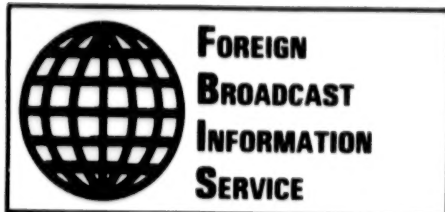


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ADVANCED MATERIALS

Germany: Volkswagen Foundation Funds Materials Science Project

MI2311100593 Bonn TECHNOLOGIE-NACHRICHTEN
MANAGEMENT-INFORMATIONEN in German
15 Oct 93 p 13

[Text] Numerous applications call for surface coatings as hard as hard metals but with substantially higher abrasion resistance and lower frictional drag. Metalliferous carbon hydrides are ideal for ultrathin coatings, as they can be used to produce multifunctional coatings that not only present the aforementioned mechanical properties but can be modified with regard to their electrical conductivity. Their structure must be precisely delineated and analyzed so that nanocomposites of this type can be tailored to individual requirements.

The Volkswagen Foundation, under its "Microcharacterization of Materials and Components" program, has awarded a grant of about 280,000 German marks to a project undertaken by the Fraunhofer Institute of Coating and Surface Technology in Braunschweig (Professor H. Dimigen) to develop a user-friendly method for analyzing this promising family of materials. The scanning tunneling microscope and the scanning electron microscope [Rasterkraftmikroskop] are used to establish the structural parameters of the coatings and to correlate them with the material's production parameters and macroscopic properties.

Ultrafine heads, ideally only the size of a single atom, scan the surface, and the computer converts the readings into a three-dimensional image from which important information regarding the properties of the material analyzed may be inferred. It is already known that the metal is not uniformly distributed in the coating but forms tiny metallic or carbide particles, which are embedded in a polymerlike, highly crosslinked carbon hydride matrix. These particles, which measure only a few millionths of a millimeter, will now be rendered directly visible, so it will be possible to determine their shape, their distance from one another, and any preferred orientation. The resolution that these microscopic methods provide is so high that single atoms can even be detected in certain circumstances.

The scanning microscopes will be used to determine the electrical and mechanical properties as well as to present the nanostructures in visual form. The same sharply pointed scanning heads will then be used to perform measurements—accurate to the millionth of a millimeter—at specific points on the sample. It is anticipated that these analytical methods, some aspects of which have been newly developed for this purpose, can subsequently be used to good effect to study other materials.

Further information may be obtained from Professor H. Dimigen and Mr. K. Sciffmann, Fraunhofer Institute of Coating and Surface Technology, Bienroder Weg 54e, D-38108 Braunschweig, tel. 040- 547218-65 (Hamburg laboratory).

Germany: Low-Cost Manufacturing Process for Fullerenes Developed

MI2411135893 Bonn TECHNOLOGIE-NACHRICHTEN
MANAGEMENT-INFORMATIONEN in German
28 Oct 93 pp 8-9

[Text] The third modification of elementary carbon, after diamond and graphite, which scientists see as embodying one of the crucial key technologies of the next century, is termed Buckminster fullerene. The potential applications for this new class of materials range from light-weight batteries for electric vehicles, through malleable superconductive plastics and diamond-hard materials and surface coatings, to an incalculable variety of products such as paints, fertilizers, and plastics. However, before they can make the breakthrough into widespread use, adequate quantities of fullerenes must be available at affordable prices. It has only been possible to produce them to date in a relatively costly process and in minute quantities, the price ranging from 1,000 to 4,000 German marks per gram. A German development team has now developed a new production process whereby fullerenes can for the first time be mass-produced on an industrial scale, considerably more simply, cheaply, and rapidly than was previously possible. Fullerenes are spherical, closed, hollow cage-like structures consisting of pure carbon, the most prominent representatives of which consist of 60 or 70 extraordinarily reactive carbon atoms. Unlike diamond, which insulates, and graphite, which has metallic conduction properties, they are semiconducting materials.

The C60 molecule has the ideal football shape, whereas the C70 molecule is egg-shaped like a baseball. These molecules present a previously unimaginable combination potential, which is further enhanced by the fact that they not only offer a gigantic surface onto which other elements can dock, but they also have an inflatable cavity that can be filled with, for instance, metals, rare earth metals, gases, etc.

Embedding alkali metals in the fullerene cage thus creates superconductors that work even at relatively high temperatures. Fullerene molecules are also capable of reversibly absorbing electrons and, therefore, of storing and releasing electrical charge (as batteries). Another outstanding feature is their extreme material strength: It has been calculated that C60 carbon is harder than diamond.

This wonder material (patented by Donald R. Huffman and Wolfgang Kraetschmer) has been produced to date by vaporizing comparatively expensive, high-purity graphite rods at subatmospheric pressures ranging from 50 to 100 mbar in an electric arc. Only batch quantities can be produced by this method.

A German development team has filed a patent application for a new reaction process, having apparently succeeded in devising a method whereby fullerenes can be produced on a continuous basis from reasonably priced raw materials containing carbon in powder or granulate form.

This method also makes it possible to recycle unconverted soot fractions in the circular process, thus giving an

almost 100-percent yield. The recycling of unconverted raw materials also prevents disposal and environmental problems caused by waste matter. The reactor can, moreover, be operated at normal pressure, with all the process engineering advantages that this entails.

Another feature of the process is a modified C60 and C70 distribution. There are thus few higher fullerenes and an unusually large number of eluted substances that cannot be characterized, probably fullerene oxides below the C60 spectrum. Last but not least, one of the outstanding innovations inherent in this reaction process is that the fullerenes can be simultaneously produced and fused with other substances.

Overseas companies have recently shown a lively interest in this novel production process, and the developers aim to expand their current laboratory-scale reactor into an industrial-scale plant. They are therefore seeking partners with the requisite capability in the chemical, plant engineering, coal, electronics, and pharmaceutical industries for this purpose. Further information is available from Juergen E. Christians, Kirchenstr. 8, D-69239 Neckarsteinach, tel./fax 06299/1290.

AEROSPACE

Germany: Change in DARA's Management Announced

BR0610111393 Munich SUEDEDEUTSCHE ZEITUNG in German 15 Sep 93 p 25

[Text] The federally owned German Space Agency (DARA) faces a change of management. Director-General Professor Wolfgang Wild, who has headed DARA since its foundation in 1989, will resign early as of 1 October, confirmed a DARA spokesman in answer to an enquiry.

His successor is expected to be Jan-Baldern Mennicken (class of 1935), head of the Federal Research Ministry's Department of Aerospace, Environment, Marine, and Polar Research and Earth Sciences. The Federal Cabinet is scheduled to give the appointment its formal approval today. Mennicken's successor has not yet been chosen, say sources in Bonn: DARA's supervisory board, on which the Federal Government, industry, and science are represented, will meet to discuss the matter on 20 September, Wild's 63rd birthday. The one-time (1987-1989) Bavarian science minister's contract officially runs until mid-1994, and both health and substantive reasons are given for his early departure. According to the DARA spokesman, Wild himself maintains that the decisions adopted by the European space ministers at the ESA [European Space Agency] conference in Granada in November 1992 have to a certain extent brought his work to a close. As regards his term of office ending in 1994, Wild is reported to be of the opinion that his successor should take over now, as decisions on European space policy are due to be made before the end of the year.

However, it is also rumored unofficially that Wild is experiencing "a certain amount of frustration" at the lower profile attributed to DARA and space policy in these times of empty government coffers. It is also said

that Wild complains of a lack of commitment to space policy on the part of the other ministries. Bonn circles do not rule out the possibility of additional changes at board level and job losses among DARA's 270 employees.

Germany: German Aerospace Presents Advanced CNC System

BR0610110993 Munich SUEDEDEUTSCHE ZEITUNG in German 15 Sep 93 p 25

[Text] At the start of the EMO machine tool fair in Hannover, Munich-based German Aerospace AG (DASA) presented a product that could help pull German manufacturers out of their dependence on the Japanese. DASA has developed a new CNC (computerized numerical control), which goes by the name of MK21 and is designed for economy and flexibility. The MK21 is a conversion product and is scheduled to be ready for its market launch in mid-1994. DASA has stated that it is open to any sort of joint venture.

Controls account for 20 to 25 percent of the overall cost of a machine tool, being first and foremost the machines' "computer brain." Japanese manufacturers dominate this important sector of the market, with German machine tool producers lagging further and further behind, according to the Association of German Machine Tool Factories (VDW). One of the factors contributing to their loss of ground is their poor performance in terms of costs, which is in turn due to excessively small orders per item and excessively slow product development. It is the VDW's view that a joint European commitment on CNC would be one way out of this dependence on the Japanese for controls.

DASA's entry into the machine tool market could mark the beginning of a joint effort. The MK21 control is a conversion product and is based on DASA's decades of experience in aerospace equipment regulation and control, it was explained in Hannover. The MK21 was composed of mass-produced standard components, although it could also be customized at low cost and could be programmed with proven tools.

There are currently two types of control on the market: mass-produced standard controls (mostly from the Far East) and those tailored to an individual machine tool manufacturer's specifications. The latter are usually produced in small runs, and this puts the price up. DASA claims that it is filling a gap in the market in this respect.

DASA has developed the control in close collaboration with AEG AG of Frankfurt, another member of the Daimler-Benz group, and it will be marketed both directly and through AEG. DASA is showing a prototype of the new product, which is scheduled to go onto the market in mid-1994, at EMO, and it expects to sell around 160 controls in the coming year. It has discussed the possibility of a joint venture with two machine tool manufacturers to date.

Germany: DARA's R&D Status, Prospects Outlined

MI2311145193 Bonn *TECHNOLOGIE-NACHRICHTEN
MANAGEMENT-INFORMATIONEN* in German
15 Oct 93 pp 7-8

[Text] The German Space Agency (DARA) operates not only as a project leader for the BMFT [Federal Ministry of Research and Technology], but can also, according to the provisions of the Space Transfer Law, carry out the following functions autonomously:

- Carrying out German aerospace planning;
- Representing the federal government internationally, particularly in relation to the ESA;
- Implementing the German space program.

DARA has taken the basic concept of project management beyond that of cooperation at ministerial level, and developed it into the main concept of carrying out functions autonomously, under the political control of a federal department, stated BMFT Parliamentary Secretary Bernd Neumann in reply to questions by FDP [Free Democratic Party's] deputies Juergen Timm and Professor Karl Hans Laermann.

An essential feature of this autonomy is DARA's degree of responsibility, enabling it to act with full authority. Its second peculiarity is the focus of space management at a level below the departmental authority of the ministries concerned.

In its interim report of 31 March 1992 to the research committee for transferring space functions to DARA, the federal government set out in detail the difficulties arising in implementing the main concentration project. Two of the points made there have now developed as follows:

- An agreement has been reached with DBP [Deutsche Bundespost] Telecom concerning support over strategic telecommunications issues, particularly in the area of mobile communications systems, amounting to four to five man years; the agreement will be signed shortly.
- The BMVG [Federal Ministry of Defense] has issued three contracts to support its specialized activities in defense-related potential applications for telecommunications and Earth observation, amounting to 900,000 German marks [DM].

Although the other prospects have not yet produced definite orders, they have probably led to a significant increase in cooperation. DARA's efforts are concentrated in two areas:

- Acquisition of orders;
- Promoting potential demand from possible users.

This must be accompanied by a willingness on the part of federal agencies to make greater use of the scope they have for space applications, and to provide funds for this.

One of DARA's primary efforts is the promotion of competition among companies, and the marketing of space-relevant products and services. To this end, DARA

wishes both to improve the general conditions of in which contracts are allocated and executed, and to assist the expansion of technology transfer from space-related R&D outcomes.

Medium-sized firms, which frequently find it difficult to acquire and maintain expertise in key technologies, are expected to be the main beneficiaries of the new program. In addition, the size of these firms tends to put them at a disadvantage in the market-place. Therefore, another goal of the program is to intervene so as to support such firms in improving their market prospects: To survive in space-related industries, small and medium-sized companies (SME's) also need special skills, processes or facilities, together with the capacity for international cooperation.

The approach used in the SME innovation program makes it an unusual component of the DARA SME and marketing program, the objective of which is to familiarize medium-sized firms in various industries with current issues, developments, potential applications and processes in the space program, while preparing them to bid for national and international contracts under space programs. To this end, call for bids were recently requested under a competition for new ideas, open to many firms throughout Germany, which were invited to submit innovative space-relevant ideas. Prizes are being awarded in individual cases by a DARA specialized jury to the most promising suggestions: The 55 proposals submitted (just a third of which originated in the new laender) are presently being evaluated.

From 1994, DARA will also be arranging conferences, symposia and one-day events for SME's, to enable the exchange of ideas and discussions between such firms. Land governments, and where appropriate, the Research, Transport, and Trade and Industry Ministries are also expected to be involved.

In addition, at the beginning of 1994 DARA is to publish an information system for medium-sized firms, containing data on space projects planned by the federal government, together with information on firms active in space-related industries, or considering such involvement in the future.

As part of the reorganization of DARA, a major department, "Industry and Market", has been created, with subdepartments for "SME's and Market Development", and for "Industrial Affairs, IPC", thus creating seven jobs, six of which are already filled.

Germany: R&D on Nonpolluting Aircraft Engines Continued

MI2311142993 Munich *SUEDDEUTSCHE ZEITUNG*
in German 28 Oct 93 p 50

[Article by Thomas Buehrke: "Aircraft Engines on the Test Bench—New Ideas for Reducing Polluting Nitrogen Oxide Emissions From Aircraft"]

[Excerpt] In the light of satellite surveys, experts from the German Aerospace Research Institute (DLR) in Oberpfaffenhofen, near Munich, believe that passenger aircraft

have given rise to a half-percent extension in cloudage. However, the effect that this has on temperature is not known. Thin ice clouds bring about warming, whereas thick clouds cause cooling; which effect predominates is not known.

Raising Profits by Using Less Fuel

Meanwhile, engineers are seeking "new aircraft engine designs that will consume 10 to 20 percent less kerosine and discharge up to 80 percent less nitrogen oxide," says Jost Schmidt, head of Munich-based MTU's development division. Fuel still accounts for about a third of an aircraft's overall running costs, and a two percent cut in running costs would double an airline's annual profits. Moreover, there are countries that levy an environment duty: For instance, the Swedish government has for four years been levying an emission-dependent tax on civil aircraft landing at Swedish airports.

There is a large market waiting for the engine builders: Experts put sales over the next 10 years at \$120 billion in the civil sector alone. However, the cost of a research program to develop a new type of engine is put at \$1-2 billion, an investment that the experts say would take about 15 years to amortize.

Four years ago, Pratt & Whitney, FiatAvio, and MTU formed a joint venture to build the advanced ducted propulsion (ADP) proposed by Pratt & Whitney engineers and prepare it for testing. The project is linked to an experimental and engineering program for future propulsion systems subsidized by the Research Ministry in Bonn, which has already poured a total of 100 million German marks into the project.

A test proptype of this new engine successfully underwent initial trials on a test bench in Florida just under a year ago, and special functions, such as the reverse thrust, have just been tested in a NASA wind tunnel in California.

ADP is based partially on conventional principles but operates with greater efficiency than current engines. The engineers have achieved this result by substantially raising what is known as the by-pass ratio. Part of the air normally flows through the inner core area, while the rest flows past it on the outside, providing the desired propulsion. The drawback inherent in raising this by-pass ratio is that it increases engine diameter by about 50 percent. If the advantage of lower fuel consumption is not to be canceled out by the weight gain, new materials must be developed that will be as light as possible while withstanding extreme loads. MTU is therefore undertaking research into fiber-reinforced composites about three times as light as titanium. The engineers are confident that ADP will be in use by the turn of the century.

An MTU idea known as CRISP (counter-rotating integrated shrouded propfan) goes a step further, having not the usual single rotor at the engine intake, but two rotating in opposite directions, thus increasing the air throughput. However, CRISP research is currently on the "back burner" for financial reasons.

Hydrogen Brings Problems

Last but not least, "alternative" fuels are still being fielded as a means of reducing exhaust emissions. Veritable miracles are being attributed to hydrogen in particular, although engines running on hydrogen discharge double the amount of water vapor emitted by a conventional engine and would thus increase cloud formation. Moreover, the assumption that an aircraft running on hydrogen would discharge nothing but water vapor is false.

NASA research showed 20 years ago that at high combustion temperatures nitrogen oxidizes out of air to form nitrogen oxides. Discharges of these gases cannot actually be reduced by introducing alternative fuels: New, more efficient combustion chambers would be required even in this case. Creating them would entail exploring virgin territory in engineering, because the hydrogen has to be cooled to below minus 252 degrees Celsius in the tanks, with the risk that components might ice up or become brittle. Moreover, energy content for energy content, hydrogen is four times more voluminous than kerosine, so additional tanks would inevitably have to be incorporated.

Germany: DASA Faces Financial Difficulties

MI1211170093 Bonn DIE WELT in German 20 Oct 93 p 14

[Text] DASA President Juergen E. Schrempp is under pressure. His Deutsche Aerospace (DASA) is again planning deep reductions into expenditure: The Daimler-Benz subsidiary will today announce a wide-ranging "package of measures," intended to save approximately one billion German marks [DM] to Germany's largest aerospace and military technology company, whose 1992 revenue was DM17.3 billion.

The new package of measures implies restructuring of the core businesses of aerospace, as well as defense and civil aviation systems. The reorganization also includes a marketing and sales plan to enable DASA to exploit potential markets overseas.

However, the package of "aggressive measures" to be presented today by DASA's board of directors will inevitably mean that previously planned personnel cuts throughout the company will be exceeded. Originally, 10,500 of the 82,000 jobs in the company were to go by the end of 1996. Insiders within DASA are now suggesting that such measures as closure of DASA factories in southern Germany will "considerably increase" this figure, although it will remain below 20,000. DASA's factory committee considers things will get even worse, and fears 25,000 jobs will be cut.

The dramatic deterioration in overall conditions is given by DASA management as the reason for its new strategy. The fall in public-sector orders has now been followed by a collapse in demand for civil aircraft.

European jet manufacturer Airbus Industrie, in which DASA has a 37.5 percent stake, has had to revise its 1993

production target of 200 units down to 120: Altogether 150 Airbus orders have been canceled since the beginning of the year.

All this has consequences for DASA's revenue and order books. DASA's Executive Hartwig Knitter stated at an employees' meeting in the middle of October that the Munich-based company's revenue was likely to reach only DM18.9 billion by the end of 1993, instead of the projected DM20.1 billion. Forecasts of orders have also been revised downward, from DM20 billion to DM17.1 billion.

"We must make savings at every turn—and we are doing so," Personnel Manager Knitter recently wrote in DASA's in-house publication, announcing a stringent rationalization program, which he estimated would achieve annual savings of around DM200 million. The goal of DASA President Juergen E. Schrempp, who is considered to have an excellent chance of succeeding Edzard Reuter as Daimler-Benz president, is clear: To make DASA profitable by 1995. DASA managers believe their package of measures will achieve this objective—provided that political and economic conditions do not deteriorate further.

Timetable, Requirements for Ariane V Discussed

94WS0063A Paris: *LE FIGARO* in French 1 Nov 93
p 13

[Article by Jean-Paul Croize: "Ariane 5's Timetable"; first paragraph is *LE FIGARO* introduction]

[Text] The new version of the European launcher will differ technically from previous ones. Its first launch is scheduled for late 1995, with commercial operation beginning a year later.

Europe's giant Ariane 5 rocket should fly 15 times before the end of the century. So said Charles Bigot, the CEO of the rocket's marketing firm Arianespace, at the Ariane industrial show just held in Paris. Over 900 specialists from some 240 firms and 13 European countries involved in making Ariane attended the show, which gave the program's promoters the chance to give a particularly optimistic update on the rocket. With a total of 120 launch contracts signed since it went into service, the Ariane rocket developed under the aegis of the European Space Agency is a total technical and commercial success.

On the technical front, Ariane has failed in only five of the 60 flight attempts it has made since the end of 1979. That, combined with its unbroken string of 23 successful flights over the last six years, has boosted its reliability rate to over 95 percent, well above the 90 percent its designers aimed for. On the economic front, Ariane has captured 60 percent of the world's market for civil satellite launches. Moreover, with 39 contracts still to be carried out, the rocket is worth 17.3 billion French francs [Fr] in sales, and will provide work for 12,000 people in Europe for the next three years. But now the company must hang on to its leading position. "You have three years to succeed," Gerard Longuet, industry minister, told the specialists who met in Paris. Longuet reminded them that the fate of Ariane was still in their hands. As everyone knows, the

present version of the Ariane 4 rocket is slated to be replaced gradually by a much more powerful launcher, christened Ariane 5, beginning in 1996.

Competitiveness

The design of the Ariane 5 relies on profoundly different, "American shuttle" type technology. Highly powerful auxiliary powder boosters frame the launcher's main body, which features a cryogenic engine. To be competitive, the new launcher will have to satisfy two objectives. First, it will have to improve Arianespace's launch capabilities by enabling it to simultaneously place into geostationary transfer orbit two satellites weighing about three metric tons (the most powerful version of the current Ariane 4s can only carry 4,500 kg to GT orbits). Second, as Charles Bigot stressed, its production costs will have to drop 20 percent to win the competitiveness war against "expanded" competition. Future rivals may include the Russians, Chinese, and Japanese, in addition to the Americans. The response to this challenge is expected very soon. Current Ariane 4s will continue to fly a very full schedule—10 flights a year in 1994 and 1995, according to announcements made at the show—until nearly the end of the century. But the first experimental launch of the Ariane 5 is expected in the fall of 1995, in keeping with its planned start-of-service date a year later, following a second test flight.

Arianespace must stick to this timetable if it wants to pursue plans for a three-year "overlap period" between 1996-99. During that period, the new launcher will gradually replace the Ariane 4 by making some 13 commercial flights.

And in 2001, the reason for the Ariane 5's reliability rate of over 99 percent will become apparent when it launches Europe's first manned space capsule. Providing, of course, that ESA member countries agree to build the capsule over the next few months, as a replacement for Hermes, which the Ariane 5 was designed to launch almost 10 years ago.

Italy's Alenia's Domestic Problems, Interest in Airbus Noted

937WS0538C Duesseldorf: *HANDELSBLATT*
in German 15 Jun 93 p 22

[Unsigned article: "Alenia. In Italy as Well the Aircraft Industry is in Crisis. Problems With Labor Unions. Now They Also are Interested in the Airbus"]

[Text] The Italian air and space company Alenia was represented at the air show in Paris, but with rather dampened hopes. The announcement of the Italian defense ministry that the air force possibly will acquire American F 16 fighters in a leasing deal unquestionably was like a stab in the back. The manager of Alenia-Finmeccanica, then also in Paris, intimated that such a decision could lead to the laying off of an additional 3000 workers in the aviation industry. At the same time, however, it would mean the final end of the fighter 90. Italy, at any rate, will start to deliver the third prototype of this fighter to Germany and England in the coming spring.

Here also, according to the Italian point of view, the last word has not yet been spoken. Rome might settle for a slimmed-down variant of the fighter 90. In any case the Italian company in the future will reduce attention to the military field in favor of civilian orders, and especially work on regional aircraft, different variants of the ATR. Naturally the Italian aircraft industry also has been effected by the internal political developments in Italy with the many corruption and bribery scandals. Necessary decisions at the governmental level were made only hesitatingly and with delay. The question as to whether Italy in the future will develop cooperation with American industry and especially with McDonnell Douglas, in particular, or stick to the map of Europe, is still open. At any rate, it was astonishing to hear in Paris that Alenia-Finmeccanica also will participate in Airbus if there is a corresponding participation share amounting to about 20% for them. The problems with the labor unions, which called a strike in March after the announcement that layoffs were inevitable, have still not been resolved by the company, although for the time being a truce has been declared. A slimming-down and a further increase in efficiency also is not precluded for Alenia.

Germany: Goals, Firm Financing for Space Program Needed

937W50538A Duesseldorf HANDELSBLATT
in German 15 Jun 93 p 22

[Unsigned article: "Heinzmann: German Space Activity Stands at the Crossroads. Setting Clear Financial Limits Necessary"]

[Text] At the Paris Air and Space Show Werner Heinzmann, member of the executive board of Deutsche Aerospace (Dasa), pointed out the billions of investments of Germany during the last 20 years on projects for manned spaceflight. Of course, under the present tight money financial planning the sums allocated for manned spaceflight still made possible a continuation of involvement in international cooperation at the lowest level. A still further curtailment of these expenditures would be the same as the departure of Germany from the manned spaceflight field. After some years without continuity in projects and programs being observed in the branch it was really expected that last year's conference of ESA ministers would set new dates here. Of course, the present-day economic-political situation, and not only in the Federal Republic, has meanwhile again put in question the planning basis of the industry. Heinzmann therefore called for an immediate determination of clear political and programming goals for a German space policy, the determination of a cost-limited tolerable German budget for ensuring German positions in science and space research, as well as stabilization of construction work in the new lands of the Federal Republic. Bonn also must call upon the United States, considering the current restructuring concept for the space station Freedom, to adhere to the cooperation agreements with Europe through a very thorough consideration of the Columbus project. In addition to European cooperation within the framework of the ESA

and transatlantic cooperation with the United States, Dasa plans cooperation with enterprises in the CIS countries, first and foremost with the Russian space industry. For example, there is a joint venture with the NPO Energiya for elaborating a proposal for a European/Russian space station, as well as research for designing of a corresponding space transport ship. Within the framework of the ESA negotiable proposals will be worked out for joint work on the Mir 2 for the conference of ministers in 1995. Heinzmann of course pointed out that there also is a cooperation problem with the CIS countries. For example, the launch of a Proton booster costs only a fraction of a Western booster. This distorted competition must be stopped by means of a trilateral agreement, for example, by means of setting a quota for Russian rocket launches. This must apply until market economy conditions also again prevail in Russia. A significant pillar in the commercial business of Dasa is precisely the production of rocket stages for the Ariane 4. Heinzmann: "We are not ready to support the viability of Russia's space industry with financial support if at the same time the Russian capabilities still have not been restructured on market economy principles and are capable of ruining the efficient space transport potential of Europe in an unequal competition." Of course, above and beyond the booster business industry must achieve a reduction in its dependence on government orders. With such a realization Dasa is intensifying its efforts to develop new markets, for example in the field of observation of the Earth. In the important telecommunications field it is necessary that there be a changeover from being a pure fabricator of hardware to a supplier of systems; such a forward integration could, above and beyond the licensing agreement recently signed with Argentina for a satellite-supported communication system, bring many further orders. Otherwise the activities of Dasa with remote-controlled flight in the foreseeable future are linked with the corresponding activity of the French Aerospatiale. The joint European undertaking, which is oriented on the model of the joint helicopter company Eurocopter of Dasa and Aerospatiale, should, in Heinzmann's words, be opened up for other European partners.

Deutsche Aerospace Executive on Market for Regional Airplanes

937W50538B Duesseldorf HANDELSBLATT
in German 15 Jun 93 p 22

[Unsigned article: "The Door is Still Open for Cooperation With the ATR Consortium"]

[Text] Deutsche Aerospace (Dasa) in the coming years is planning on a 4.9% annual increase in air traffic for jets with more than 70 seats, as well as a 6.4% increase for turbojet aircraft with 70 or fewer seats. These figures were given by Hartmut Mehdor, a member of the Dasa executive board at the Air Show in Paris. In the calculations allowance was made for the foreseeable development of high-speed trains in Europe and their influence on regional air transportation. For distances less than 500

km, according to Mehdorn, trains have a distinct advantage, but beyond that there is a great growth potential for regional air transport, especially also with respect to the opening a new link between eastern and western Europe. In regional aircraft construction Dasa furthermore is striving for cooperation with the French Aerospatiale SA and the Italian Alenia SpA. To the question whether Dasa is interested in investing in Aerospatiale after its privatization, Mehdorn feels that a decision on this point rests with Daimler-Benz AG. He himself would not preclude the idea of a sort of cross-shareholding. About 70% of Dasa production, especially within the framework of the Airbus program, already is realized in cooperation with Aerospatiale and it is in the interest of Dasa to continue in this way. "I do not see why we also cannot exchange shares," according to Mehdorn. Daimler holds 85.3% of Dasa, of which 51% belong to the Dutch NV Koninklijke Nederlandse Vliegtuigenfabriek Fokker, engaged in the construction of aircraft with between 70 and 130 seats.

More Powerful Ariane-5 Rocket to be Developed

937W50578A Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 22 Jun 93 p 8

[Article by Wolfgang Engelhardt: "The Final Dash Has Begun for the European Ariane-5 Booster. The Good Points are Accumulating. High Thrust Should Afford a Competitive Advantage"]

[Text] After the Hermes space glider and Columbus orbital station were cut back greatly due to the lack of money, the Ariane booster now remains the only large European space project. Until now there have been almost 60 launches of different Ariane variants since the year 1979 with only five failures and thereby about 100 payloads have been put into their stipulated orbits. During recent years the Ariane-4 booster has accounted for over two-thirds of the commercial international satellite launch business. In order to maintain this position it was decided to build a new, larger Ariane-5 rocket. Now "milestones" and good points are piling up in the manufacture of the numerous large components for the new, stronger European rocket, in which German enterprises also have a controlling share. The latest of these milestones will be on 24 June in the Dornier House on Lake Geneva where the first payload carrier structure for the Ariane-5 booster, called the Speltra, will be put on display. This cylindrical construction part, 7.1 m high and 5.4 m wide, can hold two large satellites, one above the other, and then release them one after the other in an Earth orbit. Speltra is at the same time a supporting and protective structure and forms the outer skin of the payload fairing at the top of the Ariane-5 rocket. A few weeks before the Speltra presentation the first complete payload fairing was flown aboard a Russian Antonov 124 transport plane from the manufacturer Contraves in Switzerland to a special test stand in the United States. This structural component is 12.8 m long and 5.4 m in diameter. In a large NASA vacuum chamber the opening and separation of the payload fairing, which consists of two halves, will be tested

under full-scale conditions. Another significant milestone in Ariane-5 manufacture was in February of this year with the first successful burn test of a large P 230 solid-fuel booster in the work area in French Guiana directly near the launch site. According to the evaluation based on readings from about 600 sensors, all the temperature and pressure values in this "hellfire," as well as the mechanical loads and the developed thrust, were within the planned tolerances. The Ariane-5 in each launch will be outfitted with two of these auxiliary rockets 30 m long, 2 m wide and weighing 237 tons. These boosters together furnish a thrust of 1300 tons for two minutes. Prior to the first flight provision is made for seven other such tests in order to recheck the construction and functioning of this European booster with the greatest thrust. The time schedule until now also has been adhered to in the development program for the "small" upper stage of Ariane-5. Recently the first construction model for a vibration load test developed by Erno Dasa in Bremen was turned over to the Deutsche Forschungsanstalt fuer Luft und Raumfahrt (DLR). Previously there had already been oscillation tests with the propelling and orientation system of the booster upper stage. The first "hot" burn tests for up to 24 minutes will be carried out in a few weeks. This apparatus will later in an Ariane-5 launch carry the payloads from lower into the planned higher orbits. The stage situated beneath the payload fairing is 3.96 m wide and the engine is 3.35 m high. The empty weight is 1150 kg. Fully fueled it weighs 11 tons. Also the other construction parts for the Ariane-5 booster immediately after their fabrication are subjected to numerous tests of their conformity to specifications. For years now burn tests have been conducted with the Vulkan engine for the central principal stage using test stands specially erected for this purpose at Lampoldshausen near Stuttgart and at Vernon near Paris. This cryogenic drive, with ultracold fluid-water and oxygen fuel, during the Ariane-5 booster launch must function for 10 minutes with a thrust of 104 tons in order to put the payload into a low orbit. With all the satisfaction with the continuing technical progress in Ariane-5 development there are, however, some problems in the financing of the new booster. The budget limits for the time being are 9.8 billion DM, but this amount will evidently be exceeded by about 15%. The governing French space agency CNES, which is in charge, has strictly adhered to this because a 20% cost overrun would have given the participating European countries a juridical pretext for dropping out of the Ariane-5 program. The reasons for the cost overruns are technical problems with solid-propellant boosters, but organizational and financing errors also must take their share of blame. Parallel with the speedy technical fabrication of the Ariane-5 booster, the first marketing efforts are now underway for the sale of launch services of the new Europa booster. Soon after the first two certification launches, commercial launches with the Ariane-5 should take place by the turn of the year 1995/1996. During the three-year transition phase the production of the old Ariane-4 booster will slowly come to an end; after that only the new large boosters will be launched—if at that

time no weighty technical problems have arisen. A considerable advantage of the European booster in comparison with the American, Russian and Chinese competitors is their thrust, with which most double launches become possible. The new Ariane-5 has a load-lifting capacity of almost seven tons for a geosynchronous transfer orbit. A launch of the Ariane-5 will cost about 165 million DM. Thereby, in comparison with the still used Ariane-4, there will be a cut in launching costs per each kilogram of payload by half. These favorable calculations could be underbid at best by the Russian Proton booster, whereas the American Atlas-Centaur with a satellite and the Titan booster with two payloads should be about twice as expensive as the Ariane-5. The Ariane Space marketing enterprise is intensively preparing for the new booster. A fifth of all personnel already is working on the sale of launch capacity with the dissemination to potential clients of details on satellite transport up to mid-1996. In the years which follow there should be first two, then three and finally, four launches of these boosters annually. Also in the participating European industry intensive preparations already are being made for the production of the new Europa booster. In Germany these are the Dasa branch MBB, Munich, and Erno, Bremen, as well as MAN in Augsburg, which have assumed about 20% of the production costs for the Ariane-5 booster, corresponding to German participation in this European project.

Italian Project To Build Rocket To Launch Low Orbit Satellites Considered

93WS06304 Rome IL MESSAGGERO in Italian
24 Jul 93 p 16

[Article by Luciano Ragno: "With Vega, Italy Enters Into Orbit"]

[Text] *A "BPD" project to launch scientific and commercial satellites. Within four years, the first Italian rocket in space. Study is entering the testing phase, but a few unknowns have still to be resolved. Open debate also on cost of the operation. Minister of Universities and Research Umberto Colombo entrusted with delicate role of mediator. Importance of reconciling scientific space research with economic needs of the country.*

Vega is the name of a star in the constellation Lyra. Rather soon, these four letters will be painted, alongside an Italian flag, on the back of the first Italian space rocket. Its mission will be that of all more or less big rockets: lift off from the earth in a sea of fire, embark on the road to the stars, leave in orbit one or more domestic or foreign, scientific or commercial satellites, then make itself scarce, there being no plan to recover it.

If everything goes as planned, it will all occur in a relatively short time: Three years for its development, one year of test flights, and, we add, six months of contingencies—and at a cost of less than 500 billion lire. An ambitious program, that of "BPD Defense and Space," with head office in Colleferro, a short distance from Rome. The intent is to finally put our country, which has always been a player in the scientific space market, into

the economic space market, in the segment dealing with the putting in orbit, for third parties, of satellites weighing between 600 and 1,000 kilograms. An ambitious project, as we have said, but, a close reading reveals, also a message of faith in a tomorrow that many paint in gloomy tints. And in any case, a window opened on employment, which, in other fields, is, to say the least, problematic.

"BPD Defense and Space," the manager of whose Space Division is engineer Pier Giorgio Romiti, has planned several configurations of the launch vehicle: one based on four motors, capable of carrying a payload of 1,000 kg; one based on two motors, for a payload of 500 kg; and one capable of carrying 250 kg of payload.

The launching facility of first choice is the Italian launch proving platform offshore from Kenya, which could be used for calibration tests as soon as current modernization work on the platform is completed. The definitive launch site could still be the "San Marco," of course, but also any other site meeting the required conditions. What is certain is that the international space world is already showing interest. And that is a good sign.

At the moment, Vega has before it all the problems normally besetting a rocket prior to its attainment of maximum reliability. But the Vega is faced with an additional one from the very outset: that of having to withstand the chill wind of polemics that is assailing the space sectors, and ours above all. Not that the situation outside of Italy is any better. Gusts of criticism are blasting away at NASA projects; Ariane is navigating in choppy waters, because launch vehicles by the bundle could soon be coming off the ex-USSR space industry production lines and be put on the market at giveaway prices. And an icy wind is blowing in Italy as well, where the largest-scale Italian research program, space, has been being blasted by legal battles, Parliamentary hearings, Court of Audits reports, committees of wise men who have created a wall that for the moment is a solid bastion between the Space Agency and the majority of "La Sapienza" [Knowledge], the University of Rome's Academic Senate.

It is news of the day that Minister Colombo has frozen the funding earmarked by the state for the realization of a project conceived by Professor Luigi Broglio, which calls for acquisition of the American "Scout" rocket, and its conversion and use for the launching of commercial payloads from the Italian proving ground platform offshore from Kenya, after modernization of the platform, all at a cost of 90 billion lire. In an interview given to IL MESSAGGERO, Prof. Broglio accused the Italian Space Agency of having blocked the project. And in a flurry of controversy, Prof. Broglio has resigned from the Agency's board of directors.

It is also no secret that the Italian Space Agency is mired in bitter internal controversies, which it manages to circumvent at the last minute, but which should be resolved with expiry of the terms of the directors within some ten days or so.

Everything is in the hands of Minister Colombo, who is well aware of the scientific values of space research, but who, very realistically, is not underestimating our country's economic needs. Colombo is aware that Prof. Broglio's experience must not be lost, that the offshore proving platform at Kenya must be maintained, provided the economic sacrifice is not excessive and on condition of detailed guaranties by the Nairobi government. At the same time, the minister of universities and research wants to give clear sailing to the Space Agency, which is being subjected to centrifugal forces emerging from diverse interests. And to judge from initial indications, Colombo's approach, as compared with the past, shows signs of perceptiveness, decisiveness, and capability of intervention. One of these signs is Colombo's intent to put before the CIPE [Interministerial Committee for Economic Planning] a proposal for a national launch vehicle, which in all probability will be the Vega project.

Colombo is seeking an agreement among the various organizations involved to cooperate in making Italy a player on the world scene at a moment when a market niche is opening for small, low-cost satellites. Suffice it to note that there are many universities in the world with a few billions at their disposal for the launching of a satellite of their own. Who knows but what a start toward economic recovery might not be lurking in space. It might just be a coincidence, but let us not forget that Vega is a part of the constellation Lyra [spelled Lira in Italian]. On condition, however, of an abatement of the chilly north wind, although, when one thinks about it, a gentle breeze has always blown across the "highway to the stars."

AUTOMOTIVE INDUSTRY

Belgium: Advanced Catalytic Converter Developed

94WS0043B Paris INDUSTRIES ET TECHNIQUES
in French 10 Sep 93 p 115

[Article by Thierry Mahe: "To Anticipate Future Antipollution Standards: More Economic and More Efficient Catalytic Converters"—first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Excerpt] Bosal and Corning have announced two major improvements in catalytic converters. One will reduce the required quantity of precious metal; the other will ensure that the converter is efficient from the moment the vehicle starts.

Suppliers of components for road-vehicle catalytic converters anticipate future standards concerning the discharge of noxious effluents into the atmosphere. California regulations, coming into force in 1997, are justifiably used as a reference because they are the most restrictive in the world. Bosal and Corning used them as a yardstick to measure the efficiency of their new technologies. The Bosal group, specialized in exhaust systems, offers a radial-flow converter. The prototype was designed by Pete Stennackers of the Bosal research center in Lummen (Belgium). In this new converter, the gas-catalyst exchange zone is distributed over the radial surface of the substrate rather than over the bases of a cylindrical

component. The upstream/downstream pressure gap is thus reduced by a factor of 10. The researcher explained: "We use part of that gain to provide much finer channels in the substrate: 1,600 cells per inch instead of the usual 400 (ceramic is replaced by a Fe-Al-Cr alloy). Mass transfer is improved, and catalysis made more efficient. Actually, we are relying on the cost parameter. For equal efficiency, the quantity of precious metal required (see box [not reproduced]) can be reduced by half, yielding a saving of about 25 percent on the catalytic converter cost." The first commercial products derived from this process should be used on vehicles as initial equipment starting in 1995.

HDTV Cuts Auto Design Time

94WS0036A Paris L'USINE NOUVELLE in French
9 Sep 93 p 62

[Article by Pascale Deschandel: "From R&D to Promotion Campaigns: HDTV [High-Definition Television] Is Also a Tool for Companies"—first paragraph is L'USINE NOUVELLE introduction]

[Text] Mercedes, BMW [Bavarian Automobile Factory], Ford, IBM, use it to develop their models or boost their corporate image. But its cost makes it unaffordable for small to medium-size companies...

High definition usually refers to consumer applications (television, cinema). But high definition television is also beginning to find industrial applications through R&D, design, and high-end corporate films. Sony, too, which is unable to conquer the European consumer market since the EEC is heading toward different standards (16/9), counts on the professional and corporate market.

In industrial design, high definition television may in fact make for a richer set of tools. In Germany, major automobile manufacturers, such as Mercedes, BMW, and Ford Germany, have already integrated it. "All manufacturers use graphic computers to produce artificial images and develop shapes," Rene Guignau, development director of Sony's professional division, explained. "In Germany, designers use high definition television to create mockups. At Ford, they even maintain that, thanks to the precision of high definition television, they need only a dozen mockups per model, compared with 80 formerly. By projecting the image on a screen, designers may appraise the actual-size car and skip first-order modeling. The manufacturer thus saves a lot of time in designing a new car."

Other outlets for professional HDTV: factual television which, to give an example while remaining in the automobile sector, makes it possible to show to dealers, on screen, all the stages in the manufacture of a car that is being introduced; and high-end corporate films (IBM, Ford, NASA have made prestige films). We could mention many other examples: in the film industry, of course, with advertising films, but also in museums (80 Japanese museums are already equipped). There are also significant medical applications (telemedicine) involving data teletransmission; in Japan several university hospitals are

already equipped with high-definition cameras. One of the objectives is highly educational: It enables students gathered in an auditorium to watch a surgical operation being performed in a hospital, live and with exceptionally accurate images projected on a large screen. These applications may lead to others in other fields.

Exceptional quality, however, also means exceptional cost, and that will slow down the immediate development of this technology. In fact, a Sony high-definition camera costs 2.5 million francs, and setting-up expenses climb faster than with other technologies. Eventually, however, prices should go down as a result of competition: Panasonic, Toshiba, JVC, etc., are in the race.

Hungarian, Russian Automotive Joint Venture Announced

94WS0073A Budapest FIGYELO in Hungarian
30 Sep 93 pp V-17

[Article by Gy. T.: "Hungarian-Russian Small Car"]

[Text] The idea of joint car manufacturing with one of the CEMA countries has already arisen several times during the past decades. The many good ideas remained only ideas, however, despite the fact that contracts were just about to be signed, such as for the installation of Skoda motors and transmissions into modernized Wartburg bodies somewhere in eastern Hungary.

Another plan called for the assembly of Dacias in Borsod County, based on a Renault R-19 license. Had they materialized, these cooperative ventures could have provided several benefits. Not only would these ventures have provided work opportunities for the Hungarian machine and steel industries before their ultimate collapse, they would also have prevented us from becoming Europe's used car dump. And further, cars with obsolete, two-phase engines could have been phased out on time, and a real, so-called suction effect could have evolved throughout industry. But all these are "would have's" and "could have's." True, we can be proud of our two small-car manufacturing plants, but let us admit, these exert a minimum suction effect on Hungarian industry. Even the screws are delivered from Germany to Szentgotthard, and much water is going to flow down the Danube before they press body components from steel manufactured at Dunaujvaros, or before electrical or electronic components are stamped with the Remitel or Bakony Works trade marks. The situation is not better in Esztergom either: Engines, transmissions, and running gear for Suzuki cars is going to be delivered from Japan for many years to come. At Gyor, where Audi manufactures modern cylinder heads, it makes use primarily of Hungarian expertise, electrical energy, air, and cooling water, and we must wait before valves and springs made in Hungary can be incorporated.

Somehow, the situation is similar with respect to trucks and buses, too. The well-known view held by CEMA was that Hungary should manufacture only relatively unsophisticated, low-price buses or perhaps trucks, and that the industries of the rest of the member countries should provide cars and motorcycles. And besides, we were the

only CEMA country not permitted to manufacture cars and motorcycles. We are beginning to feel the impact of all this: the unsophisticated demand placed by CEMA countries disarmed the design engineers' fantasies filled with ideas at both Ikarus and Csepel Auto, their infrastructural industrial background. This is how a situation evolved, in which Ikarus and Csepel Auto do not represent competition to the rest of the western car manufacturers, at a time when the market is expected to boom. By now, even the gaps in the Central and East European markets are becoming saturated. Just think of the cooperative arrangement between Renault and the Czech Karosa bus manufacturer, or the gains made by manufacturing Mercedes buses in Russia and China.

For these reasons we should welcome the contract consummated between Hungary and Russia for the manufacture of trucks and cars. It is noteworthy that large car manufacturers like DAF, Iveco, MAN, Mercedes, and Scania have announced—even though not officially—that they did not have a great need for the Hungarian vehicle industry. Not even the Raba-MAN relations take advantage of the Gyor plant's full capacity, and bus manufacturers are not crowding the gates at [Raba's] Matyasfold [plant] either. Let us take a look at the background of this Hungarian-Russian car manufacturing agreement.

Experiments have been going on as early as in the late 1950's to develop a simple-structure small car, suitable to run on bad roads in Russia, in the former Soviet Union. The Zaporozsec, too, started out as a small car, its first prototype was driven by a motorcycle engine and they tried to copy the small car model NSU Prinz. In the course of planning, the world-renowned professor Jante performed pioneering work at the NAMI institute, but due to the intensive development of the military industry in those days, he did not get much farther than having a prototype. The Zaporozsec developed later had little to do with Jante's concept. Meanwhile, the Volga Car Manufacturing Plant was developed with Fiat's involvement, and many believed that this would resolve the problems experienced in the buying and distribution of cars in the homeland. Life, however, was far more complicated. The war in Afghanistan claimed very many human sacrifices, and amputees could be estimated to number tens of thousands of persons. This explains why the idea of providing cars to physically handicapped persons was placed on the agenda. Three factories, the Volga Car Manufacturing Plant, the Kama Truck Factory, and the Szerpuhov Engine Factory, jointly developed for series production the VAZ-1111, also known as the OKA small car.

The three-door body accommodates four persons. The third door in the rear is made of synthetic material, and opens all the way to the bumper; this makes loading and unloading very easy. The body itself is 3,200 millimeters long, 1,420 millimeters wide, and 1,350 millimeters high. The wheel base is 2,180 millimeters, the front wheel track is 1,210 millimeters, and the rear wheel track is 1,200 millimeters. The car weighs 605 kilograms when empty, and its useful load capacity is 340 kilograms. The rear seat

can be turned down toward the front, thus yielding a larger luggage space. The instrument panel is made of Lada parts. The engine is a two-cylinder version of the Samara power source, reduced in size. The water-cooled, 649 cubic centimeter, 21.5 kW (29 HP) engine that runs quietly performs best at a rotation speed of 5,600 per minute. The distributor without a mechanical contact breaker and the gasoline pump are at the end of the camshaft. The carburetor was built pursuant to a Solex license. The gear shifts in four steps. The tire size is 135/80R12. The highest speed of the car is 120 kilometers per hour, and it accelerates to 100 kilometer per hour in 30 seconds. Fuel consumption is favorable: at speeds of 60 and 90 kilometers per hour it consumes 3.2 and 4.5 liters of gasoline per 100 kilometers respectively, and 6.0 liters of gasoline in city traffic. The gasoline tank has a 30 liter capacity. Some of the OKAs are manufactured to accommodate the physically handicapped; in these models the left front seat can easily be turned sideways. Domestic demand for such cars in Russia has declined. Anyone who has enough money to buy a small car—an OKA or some Japanese model—buys a Samara, or some larger model Mercedes, BMW, or perhaps a Porsche. This was one reason why they were searching for a different manufacturing alternative, and the Hungarian industry with much unused capacity proved to be best suited for that.

The construction of the vehicle heavily involves manual assembly, and thus it is suitable for series production in plants located in Borsod or Nógrád Counties, left without work. Polus Holding Company representing Canadian banking interests, and the Hungarian KAMAZ Ltd. founded two Hungarian-Russian KAMAZ enterprises slated to begin assembling OKA small cars and KAMAZ trucks in the assembly plant of one of the two northern Hungary factories toward the end of this year. Plans call for assembling various types of 8 and 13 ton trucks ranging from camions to building material carriers. These would be equipped with modern Cummins Diesel engines. Initial plans call for the assembly of 500 trucks annually. Cars—15,000 per year—would be assembled in another Hungarian factory yet to be selected. KAMAZ Ltd. management indicated that they have asked the Hungarian Government to grant the same tax and customs duty benefits as those granted to Opel and Suzuki. "Job creation" subsidies, and—relative to models equipped with catalytic converters—environmental subsidies would have a favorable impact on selling prices. The management of KAMAZ Ltd. claims that they could sell the Lada-1111 basic model for 300,000 forints; this model offers more than the Trabant and the Polski-126, and competes with the 1980's trend represented by the Maruti. This model could replace the two obsolete models, neither of which is friendly to the environment. Series production of the Russian-Hungarian small car is slated to begin in January 1994.

France: Renault, Peugeot Auto Recycling Networks Operational

94W50061A Paris LE MONDE in French 28 Oct 93
p 14

[Article by M.C.: "Renault Creates First European 'Green Network'"]

[Text] Like several European—particularly Swedish and German—manufacturers, Renault and Peugeot are developing their systems for collecting and recycling automobile scrap. Renault is completing installation of the first European "green network," while Peugeot is starting a pilot operation in the Nord-Pas-de-Calais Region.

Renault is completing the installation in 10 West European countries of its "green network," a system for collecting and recycling automobile scrap. From Swindon in Great Britain to Vienna in Austria and from Amsterdam to Lisbon by way of Paris, Brussels, or Milan, beginning in 1994, 1 million bumpers, 700,000 batteries, 3 million liters of solvents, 3 million tires, and 120,000 cubic meters of used packaging will be collected every year and then "reworked" (that is, transformed into new raw materials) by recycling professionals.

The network, which got its start in the Tours area and in Germany in the summer of 1991, has already made it possible, for example, to use some 120,000 used bumpers to manufacture new parts (fenders and side bumpers) for the latest Safrane, Clio, and Twingo models. The system will involve the 13,500 dealers and agents in Renault's European sales network. From every sales outlet and repair point, the same trucks that deliver new replacement parts will carry away automobile scrap to regional or national collection centers (for example, Zurich for Switzerland and Valladolid for Spain). There the scrap will be sorted and the resulting inventories in each category sent to certified recycling firms.

In cooperation with the French Scrap Iron Company, Renault also set up the first industrial center for processing junked automobiles in Athis-Mons (Essonne) in September 1992. In one year, that plant has recycled some 10,000 vehicles with what the firm reports is "a salvage rate exceeding 90 percent" and good economic profitability. In less than 10 years, "no more than 10 percent" of the weight of a vehicle will wind up in dumps, compared to 25 percent today. In addition to its existing centers (in Athis-Mons, Madrid, and Wuerzburg, Germany), Renault intends to establish new ones—notably in Toulouse. Some of them will be operated in cooperation with other manufacturers, as is already the case with BMW in Wuerzburg.

Peugeot's 'Clean Garages'

On a smaller scale, Peugeot is also concerning itself with the collection of automobile scrap (oil, batteries, and tires). In cooperation with the National Council of Automobile Professionals (CNPA), the firm in Sochaux has just launched a pilot experiment in the Nord-Pas-de-Calais Region: Car owners who maintain their own vehicles are being encouraged to bring their used materials to facilities equipped for the purpose (there will be 40 such establishments by the end of the year, plus another 200 in 1994). The used materials will then be sent to recycling centers. If the experiment is successful, the system will be extended to all of France.

Parallel with that, Peugeot is engaged in a "clean garage" operation following what the manufacturer calls "successful" testing since December 1992 by its dealer in Douai

(Nord). This operation consists of sorting shop scrap at the source for subsequent recycling.

Will the consumer find his garage bill increasing to serve the "green cause"? Renault rules out that possibility, at least "in the short term." Peugeot is reportedly considering the possibility of an "environment fee" in the name of "modern-day public-spiritedness." The reason, according to Peugeot and the CNPA, is that every year in France, 100,000 metric tons of used motor oil, 2 million batteries, and 15 million tires are thrown away, all too often in unauthorized dumps. Compare those figures to the current effort.

Renault, Volvo Presidents Recommend Merger Before Privatization

94WS0061B Paris LE MONDE in French 30 Oct 93
p 22

[Article by Annie Kahn: "Renault and Volvo Presidents Reaffirm that Merger Must Precede Privatization"]

[Text] Following in the footsteps of an association of Swedish small stockholders and a number of unions, a Swedish pension fund known as Fund 92-94 announced on Thursday 28 October that it would vote against the merger by Renault and Volvo. Most of the institutional stockholders are beginning to have their doubts as well and are holding special general meetings before Volvo's stockholders vote on the issue on 9 November.

"The merger between Renault and Volvo is a precondition for the firm's privatization." In an interview with Sweden's largest daily newspaper, DAGENS NYHETER, on Thursday 28 October, Louis Schweitzer, president of Renault, and Pehr Gyllenhammar, president of Volvo, reaffirmed that it was inconceivable that privatization should precede the merger between the two auto manufacturers. Volvo's stockholders are increasingly insisting, however, that they will not approve the merger unless privatization gets underway first. On Thursday, Fund 92-94 (which controls 2.5 percent of the voting rights) took a stand against merging first. At the same time, the Fourth Fund Managing Board, which is Volvo's second-largest stockholder (7.5 percent of the voting rights) after Renault, decided to hold a special meeting of its members on 3 November. Most of the other institutional stockholders have decided to do the same.

In Sweden, it is felt that the outcome of the balloting on the merger issue, which will take place on 9 November, is growing increasingly uncertain. In France, confidence continues to reign in the Ministry of Industry, where it is said: "We are not too concerned; the meeting may be stormy, but the merger will be approved."

But this affair bears some resemblance to the one that shook Volvo in May 1978, when an agreement was reached between Norwegian investors (including the state) and Volvo. The Norwegians were supposed to acquire 40 percent of Volvo's capital, and parallel with that, Volvo would be authorized to participate in petroleum prospecting on the Norwegian continental shelf in

the North Sea. After being hailed on all sides initially, the agreement eventually had to be abandoned for lack of a favorable vote by the stockholders, who were already hostile to the idea of selling their industrial flagship to a foreigner—even a Scandinavian one. At the time, Gyllenhammar withdrew the proposal five days before the general stockholders' meeting was held. "The two cases are different," Gyllenhammar claimed in his interview with the Swedish daily. "But the comparison is being used by opponents of the Renault agreement, who like to dramatize things. I have no interest today in playing psychology. What I can do is explain the advantages of the agreement with Renault—an aspect that has disappeared from an emotional debate."

BIOTECHNOLOGY

Germany: Hoechst Plans To Increase Genetic Engineering Tests

MI2411145093 Bonn DIE WELT in German 23 Oct 93
p 23

[Text] Frankfurt chemicals group Hoechst has now confirmed that it has applied to carry out field trials with genetically-engineered plants in Bavaria, Lower Saxony, Rhineland Palatinate and Thuringia. A company spokesman told a meeting of experts in Sulzbach (Main-Taunus district) it had lodged applications with the Federal Health Office in Berlin for the release of genetically altered maize and rape.

The proposed sites for the field trials, during which, starting in the 1994 season, the formerly restricted herbicide "Basta" will be used, are Woerrstadt near Mainz in Rhineland Palatinate, Gersten near Lingen (Lower Saxony), Friemar near Gotha (Thuringia), and Gersthofen near Augsburg in Bavaria. During the three-year field trials the herbicide will destroy weeds among the maize and rape plants. The maize and rape are said to have been genetically modified so that Basta, which kills all green plants, cannot harm them. Hoechst says that using this so-called total herbicide will make crop protection simpler and cheaper.

The German Environment and Nature Conservation Association (BUND) has already raised objections to the experiments. Chairman Hubert Weinzierl told the newspaper "Augsburger Allgemeine" there was a risk of the modified genes being transferred to wild plants. Moreover, this was the road to an industrial agricultural structure that had nothing more to do with rural farming.

European Affairs: Project To Optimize Biotechnology Information Flow

BR1011170893 Brussels XIII MAGAZINE NEWS
REVIEW in English Sep 93 pp 20-21

[Unattributed article: "Attention Focused on European Biotechnology Information Needs"]

[Text] Nine European organisations involved in biotechnology information have formed a strategic forum in

response to a report published in 1990. Entitled "Bioinformation in Europe: Strategy for a European Biotechnology Information Infrastructure", the report (co-financed by the CEC [Commission of the European Communities]) concluded that Europe lacked the focus and infrastructure to provide long-term stability to both academic and commercial biotechnology information products.

Given the immense importance of biotechnology to industrial Europe, it was concluded that greater benefit could be derived by all users and producers if biotechnology information products could be brought together.

Supported by a grant from DG XIII, the European Biotechnology Information Strategic Forum (BTSF) brings together: CAB International (UK), Excerpta Medica (NL), Inst. PASCAL (France), Pergamon Press (UK), Springer Verlag (Germany), The Royal Society of Chemistry (UK), Wolters-Kluwer Academic Publishers (NL), the EMBL Data Library (Germany) and CERDIC (France).

Modern biotechnology is highly information-dependent and uses a wide variety of information sources and technologies. The members encompass these skills, and cover the full range of sciences relevant to biotechnology, including agriculture, the environment, medicine, biomedicine and tropical medicine, biology and chemistry. The business aspects of biotechnology are also catered for. Among the members are publishers active in the field, while the EMBL Data Library produces and distributes nucleotide and related protein sequence databases, and CERDIC produces immunoclones and cell line databases.

The forum has agreed the following initial tasks:

- Identify and characterise user needs through interactions with industry platforms, advisory groups, market sectors and individual purchasers/users;
- To measure these needs against commercial, technical and political limitations;
- To develop potential solutions to such market-led questions;
- To develop systems for the long-term support of non-commercial products;
- To examine ways of interlinking products to ease the use of both individual and combinations of files and products;
- To examine ways of securing the future of independent database hosts for the European user;
- To strengthen the European information industry's response to international market and political demands.

The project will run initially for two years, although the intention is to establish the BTSF as the permanent focal point for multi-partner European project development, general commercial strategic needs, and product and

project security in the biotechnology information sector. The BTSF also plans to become a European focal point for international activities.

The partners stress that they will maintain their independent products; strategic emphasis is being placed on issues rather than individual project details. At the same time, many of the same group are investigating further research into the production of a common core database in biotechnology.

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COMPUTERS

Germany: Use of Parallel Processing for Supercomputing

94W'S0023 Munich TOP BUSINESS in German Oct 93 pp 112-120

[Article by Ulf J. Froitzheim: "Competition in Parallel"]

[Excerpts] Never before has there been such a wide selection of supercomputers - and never before has it been so confusing for the customer. However, some manufacturers are starting to feel the pinch.

Debut in Switzerland

In many cases the chips do not have to be built into a closed system as they are in the "Himalaya" computer by Tandem Computers, Inc. Basically, any workstation connected to a data network can be used. Even the wide assortment of machines in university laboratories and research institutions which are spread around the globe can work together to save costs.

To prove that the technical possibilities are truly unlimited information specialist Clemens Cap of the Eidgenössische Technische Hochschule (ETH) in Zurich started a world-wide experiment: Cap, who chose Switzerland as his residence, distributed a highly complex computing task in molecular biology among 600 computers on four continents. A few minutes later, the computers dutifully reported their respective partial results to ETH. According to Cap, this is still far from the technical limit: "Computations on 5000 to 8000 workstations in parallel are certainly not a pipedream." To be sure, not all tasks requiring large numbers of computing operations can be ripped apart in this manner. Still, this is bad news for the manufacturers of fancy and expensive supercomputers, all the more since this rather young branch of the hardware industry has a hard time anyhow to get their customers excited about their products.

More than a dozen suppliers are fighting for their share in this still rather limited market. In addition, there are a dozen different concepts: vector modules as "turbochargers" for standard mainframes, stand-alone vector computers as well as a vast array of multiprocessor systems and massive-parallel computers. A consensus that the latter will be the trend of the future is the only achievement the rivals can boast of so far.

An increasingly larger number of users is discovering the advantages of workstations. With these workstation computers researchers and developers are moving increasingly away from central supercomputers and mainframes. The central department for research and development (ZDF) of Siemens AG in Munich, for instance, has been simulating electronic circuits on available workstations for the past year. Quinghua Zheng in the development laboratory for silicon process technology of ZFE is enthusiastic about the time-saving method: "This method makes us 27 times faster."

In Ludwigshafen, quantum chemists at BASF are using a cluster of 16 IBM computers to investigate the properties of polymer materials which do not yet exist outside the computer, or they contribute to the design of new enzymes in reagent research. Since the computers are there anyhow, the comprehensive calculations of molecules up to 100 atoms are frequently done without additional cost—usually at night or on weekends. All computers are running in unison just like a parallel computer.

Inexpensive Clusters

To fully utilize capacities such installations include a master computer which continuously monitors all connected computers even during regular work hours. This makes it possible to use the computer of an employee on break for tasks required by his colleagues.

Eckhard Handke, responsible for central systems at the Society for Scientific Data Processing in Gttingen (GWDG) is very happy: "The cost of acquiring and operating workstation clusters is ten times less than that for main frames." The GWDG, a service facility of the university and several Max-Planck-Institutes, operates a considerable number of workstations and has ordered nine additional systems from Digital Equipment to replace an IBM mainframe with a vector add-on by the end of this year.

The Max-Planck-Institute for Plasma Physics (IPP) in Munchen-Garching plans to convert to mostly workstations by the end of 1994. A program which the IPP has been running on a Cray system has already been converted. Over the years the institute has been purchasing a wide variety of models—from IBM, DEC, Hewlett-Packard, Sun Microsystems and Silic on Graphics—which can all be integrated.

Wolfgang Gentzsch, CEO of Genias, is primarily known as a supercomputer specialist. However, in view of this market development he is increasingly betting on clusters. After sales to various research institutions he was able to sell the product Codine—Computing in Distributed Networked Environments—to the Volkswagen AG development department as a substitute for a mainframe.

The workstation fever has even attracted a new manufacturer. In Aachen, very close to German parallel computing pioneer Parsytec, the medium-sized firm Dressler GmbH & Co. is building a parallel super workstation with up to 50 commercial processor chips from Sun Microsystems. This "gigamachine" uses the same software as the Sun

hardware. The System with a price tag between DM70,000 and DM1.7 million is designed as a workstation network in a single cabinet. It seems that Tandem CEO and Himalaya conqueror Jimmy Treybig will not be alone at the summit.

ENERGY, ENVIRONMENT

Germany: Germany's Largest Wind-Power Plant Operational

M12311095993 Bonn *TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN* in German
28 Oct 93 p 2

[Text] The Aeolus II wind-powered generator, which was financed jointly by the BMFT [Federal Ministry of Research and Technology], the Land of Lower Saxony, the EC, and Preussen-Elektra, is the largest currently operating in Germany. It has a nominal generator output of three MW, whereas the two next-largest plants (on Heligoland and in the Kaiser Wilhelm Polder) each have a nominal output of 1.2 MW. Aeolus II has been manufactured by the Swedish company, Kvaerner Turbine AB, and MBB in Germany. Its rotor diameter is 78 meters, and the hub stands 92 meters above the ground. It is designed for an annual output of 7.3 gigawatt hours, the average power consumption of 2,000 households.

Aeolus II is a prototype with which experience will be acquired in operating wind-powered generators of this type, which are considerably larger than conventional series versions. The manufacturers will also be studying whether and how its price can be reduced far enough to make for competitive series production of these large-scale wind-power plants.

The advantage of large-scale wind-power generators is that they exploit their sites better than small plants. As a densely populated country like the Federal Republic of Germany only has a limited number of economically viable wind farm sites available, they ought to be used to the best advantage with the largest wind-powered generators available. It is still not known, however, which is the optimum plant size and whether megawatt plants can also be operated cost-effectively. Several European manufacturers, with EC Commission support, are currently developing new megawatt-range plants scheduled to come onto the market in 1995. Bernd Neumann, secretary of state to the BMFT, has announced that the BMFT will also join this initiative.

Whereas the level of German wind power exploitation was practically insignificant even a few years ago, Germany has since shown the fastest growth rate in Europe in this field. The BMFT's 250-MW wind program has played a major role here, directly funding about two-thirds (150 MW) of the total wind power output of over 250 MW currently installed in Germany, and providing the stimulus for another portion, which R&D funding makes possible. The experience thus acquired has also rendered wind power generators considerably cheaper and more economical. If the technology and price trends evident over the last few months continue, says Neumann, there

will be every reason for confidence that—at least on the coast—there could soon be no further need for grants. There are signs that the new types of plant with a nominal output of 500 kW and above are acquiring a constantly increasing foothold on the market.

Germany: BMFT Funds Soil Reclamation Projects in New Laender

MI2311095393 Bonn *TECHNOLOGIE-NACHRICHTEN*
MANAGEMENT-INFORMATIONEN in German
28 Oct 93 pp 7-8

[Text] The BMFT [Federal Ministry of Research and Technology] has approved three pioneering pilot projects to develop and test new technologies for cleansing heavily contaminated soils for which no reclamation process exists to date. The funding budget for these polluted site reclamation projects in the new federal laender amounts to more than 25 million German marks [DM]. The following cases of pollution are to be treated:

- mercury pollution at BUNA AG;
- dioxin and heavy-metal contamination at the Ilsenburg Copper Mill in the Wernigerode district, Saxony-Anhalt, and
- the Zichow "Great Hell" industrial dump used by the Schwedt petrochemical combine near Angermuende in Brandenburg.

With a DM19-million grant, the BUNA project is by far the largest of these pilot reclamation projects. From 1938 to 1990, BUNA AG used calcium carbide, plus the carbide, acetylene, and chlorine that it produced itself, primarily to produce PVC [polyvinyl chloride], solvents, and organic intermediate and special products. Over the many years that it operated, chlor-alkali-electrolysis and ethanal production by the mercury process built up a high level of mercury contamination in the buildings, production plant, and the site in general. Inadequate plant maintenance and a complete lack of environment protection systems are two of the causes, but war damage also contributed to the high level of contamination. Several thousand tonnes of mercury cannot be accounted for; they were presumably discharged into the surrounding area via exhaust fumes and effluent or penetrated the soil and the buildings and plant directly.

In addition to developing and testing advanced analysis and inspection methods for locating and assessing hazards, the project sets out to devise safe, environment-compatible, cost-effective methods for demolishing the buildings and plant using physical and thermal processes. On-site safety and health safeguards for the workers involved are major aspects. The pilot project is scheduled to conclude with a full-scale trial involving the demolition of a hangar bay and the electrolysis plant and the cleansing of a representative quantity of contaminated material and soil.

There are no technically proven and economically viable processes to date for eliminating mercury contamination. A success scored in the BUNA project would therefore

pave the way for dealing with other polluted sites as well. Mercury contamination is also present in Bitterfeld, Ammendorf, and Osternienburg, where mercury was used in electrolysis plants. In the original federal laender, the former Marktrechwitz and Eilwenn-Frankenbach sites and numerous former potassium cyanide treatment works suffer from mercury pollution.

The site of the former Ilsenburg Copper Mill and the area surrounding it have a high level of dioxin, furan, and other heavy metal pollution after decades of copper extraction from secondary sources such as PVC-covered copper cables or computer scrap without any environment protection measures whatsoever. Extreme concentrations of heavy metals are recorded in the sewers running into the Ilse drainage canal. The site is to be used in the future to extend the nearby Ilsenburg Rolling Mill, the major local employer. Dust containing dioxin blows over the urban area and the already polluted arable and pastureland, representing a high hazard potential. The drainage canal is at extreme risk, and the neighboring rolling mill, which is still operating, is under threat.

The project that has now been approved will develop reliable processes for decontaminating industrial buildings that cannot be demolished in the normal way. Existing processes will also be adapted for scrap, stockpile, and industrial site decontamination and dioxin and heavy metal-polluted residue treatment. The results of the project will be used in the reclamation of numerous other secondary raw material recovery mill sites in the new federal laender. A grant of DM4.2 million has been awarded for the first stage of the project.

The Zichow "Great Hell" is a large geologically formed hollow measuring about 12,000 sq.m, which has been used since 1964 as a dump for the former Schwedt/Oder petrochemical combine. By 1989, 100,000 cu.m of production residue and hazardous waste in solid, paste, and liquid form had been dumped there without any environmental precautions being taken. The practice of burning chlorous fluids off on the surface of the lake thus created, polluted the surrounding area with dioxins. The lack of a sealed foundation means that the dump drains directly into the groundwater and the drinking water conservation area.

The initial phase will comprise the development of a practicable reclamation strategy for decontaminating liquid and solid deposits in the light of a hazard potential assessment, and the immediate implementation of protective measures for averting the danger. The second phase envisages a pilot reclamation of part of the toxic dump using a combination of various reclamation methods. The subsidy for the first phase amounts to DM2.2 million. Here again, the existence of numerous tar lakes makes for a high degree of transferrability.

These three major reclamation projects complement the funding program that has been under way in the original federal laender since 1989 under the heading, "Pilot Reclamation of Polluted Sites," which sets out to demonstrate the efficacy of reclamation processes in the face of a

number of different, though representative, problem cases in large-scale trials and to develop new processes. Since its launch, the BMFT has spent more than DM100 million on this program. The results will be used to devise a comprehensive guide to help reclamation teams work out strategies and select the right processes.

Italy: CERN Director Discusses Clean Energy

MI2311134693 Milan IL GIORNALE in Italian
23 Nov 93 p 11

[Article by Luca Lando: "Here Is 'Clean' Nuclear Energy"]

[Text] Geneva. Nuclear energy is putting on a new suit. No tie and jacket though. Given previous experience, from now on nuclear reactors will be wearing the white overalls of research. Or blue overalls like those worn by Fermi who preferred to look like a technician rather than a professor. The reason is a simple one: nuclear energy in the future will not just be created in a laboratory, it will live there.

This at least is the opinion of Carlo Rubbia, who tomorrow at CERN [European Nuclear Research Center] in Geneva, will present a new method for freeing the energy hidden in the nucleus of atoms. Important news, it appears, seeing that the Nobel Laureate for physics has decided to talk only after having protected his invention with an international patent and after having worked for months in the deepest silence. But the reason for his reserve, according to Rubbia, appears to be something else: "The normal practice in these cases is to inform the scientific community first, so that it has time to assess the real importance of a discovery calmly. I do not want to do what Fleischmann and Pons did when they leaked everything to the Financial Times without talking to their colleagues."

The details will be revealed in the major lecture hall of what is considered by most to be the paradise of particle physics. It was in this hall that Rubbia in 1989, as director of CERN, invited Martin Fleischmann to speak in an academic, and no longer journalistic way, of that impossible dream called cold fusion. Four years after it will be his turn, as a house guest, to take on the role of the accused and convince the scientific court that clean and safe nuclear energy can exist. This time however, it will be about fission not fusion, with dividing nuclei instead of combining them.

"Reactors today are largely those conceived by Fermi 50 years ago because the way they function is based on the concept of criticality. I will explain myself better: A fission reaction consists of splitting the nucleus of an atom into two. To do this radioactive material is used and is placed alongside an element with a higher atomic weight, for example uranium. The neutrons of the first hit the nuclei of the second causing them to split up and thereby free energy. In addition to this however, other neutrons are freed, which if working in special conditions, hit other nuclei that free other neutrons that hit other nuclei and so on: this is the famous chain reaction that leads to the

production of a considerable quantity of energy. The problem is that the mechanism, once started, continues by itself. This is what happened in Chernobyl, where the core continued to burn even after the accident," said Rubbia.

But the key to understanding the energy issue, in reality is something different again. "When mention is made of energy one must remember that it is not sufficient to produce it, it must also be advantageous to do so. Nuclear fusion, for example, is by no means utopia: In experimental laboratories it is already possible to unite atomic nuclei, just like what occurs inside the Sun. The problem is that the energy we succeed in obtaining is still less than the energy expended to activate the process."

Nuclear fission instead, such as that used for the atom bomb or the reactors currently in service, produces more energy than it uses. But it does this by exploiting the intelligent but dangerous chain reaction principle. In other words it becomes advantageous only if one begins to proceed in an independent manner, something that is consequently difficult to control. "The goal of the chain reaction is to produce neutrons inexpensively: It is basically the uranium itself that supplies the bullets to destroy itself," explained the Nobel Prize Laureate. "In Fermi's day, that was the only way for fission to be convenient. But today we can follow other paths."

One example is particle accelerators, rings that are halfway between science and science fiction. Inside these rings scientists swear that the first moments of the universe can be reconstructed, and electrons and neutrons can be made to collide against one another at a speed that is very close to the hyperbolic speed of light, meaning they that could travel seven times around the Earth in just one second.

These rings, which were created to meet the needs of research, could therefore hide the solution to the energy problem. "By using the techniques available today, accelerators can supply all the neutrons that are needed, a sort of machine-gun that can be used to hit the nuclei we want to split. That is, bullets, that we can introduce into the ring from the outside, instead of letting them be produced inside the reactor. With one major advantage, that is, when we want to stop the reaction we stop firing."

The new reactor, according to Rubbia's plans, could consist of a particle accelerator with a special target at the end. And it is here, in the matter to be destroyed, that a second important novelty lies hidden. "The chain reaction path we have followed has obliged us to use highly radioactive materials such as uranium 235 and 238, which produce ashes that are impossible to eliminate because they emit radiation for 10-15 million years. Or take the 1,000 tonnes of plutonium waste we have discovered, that we still do not know where to put, and that is increasing at the rate of 100 tonnes a year with the reactors currently in service. Just think that only a few kilograms of plutonium are needed to build a bomb."

Using accelerator techniques instead we could use less troublesome materials. Such as thorium, that is as abundant on Earth as lead, and whose waste disappears within

two to three centuries. "This seems a long time, but instead it means finally solving the problem of nuclear waste because all that is necessary is to close it up in solid cement containers. Not only this but after five centuries the radioactivity of thorium "bombarded" by neutrons would become 100 times lower than the radioactivity of the nontreated mineral. The new reactors, therefore, could contribute to reducing the natural radioactivity of the planet rather than increasing it. Another point in favor of thorium is its low cost (\$80 a kilogram) and the high energy output. Just think, that one tonne of thorium is the equivalent of 3 million tonnes of petroleum, that is 27 million barrels." But the real advantage according to Rubbia is that clean nuclear energy could make us finally emerge from the delicate energy deadlock. "The environmentalists have their reasons because nuclear energy today, as safe as it may be, takes for granted that human error can be eliminated or however, kept under control. And then there is the problem of waste, which as I said is impossible to eliminate in a definitive way."

The problem however is that there is no alternative. Continuing to burn fossil fuels such as petroleum or coal is an irresponsible choice: because this causes air pollution, because the deposits are limited, and because, if there really is a greenhouse effect, we run the risk of changing the climate and causing higher sea levels. "The truth is that, we do not know whether to go to Scilla or draw near Charybdis, we are wasting precious time. Meanwhile, others are deciding on our behalf," says Rubbia. "We must realize that the energy problem affects not only the industrialized countries but also the developing countries that will need ever-increasing amounts of energy in the coming years. And to have this, when there are no other alternatives, they will be ready to use up their petroleum and coal reserves."

The only solution therefore is to open the road to safe nuclear energy, that is capable of attracting the support of the environmentalists. An impossible dream? "Not that impossible," says the physicist. "Today we possess the technology for building clean reactors. It is only a matter of using our heads and best exploiting what we have in-house, such as particle accelerators for example. What I have proposed is still not a turnkey solution, but a very promising path that could give us energy in abundance within a few years and without too many problems. The important thing at this point is to get out of this stalemate situation and roll up our shirt sleeves. Because by continuing to wait we run the risk of burning our own fingers. And suffocating a planet."

Germany: Environment Technologies in New German Laender

MI2411140093 Graefeltung UMWELTMAGAZIN
in German Oct 93 pp 28-29

[Article by Christina Barofke: "The New German Laender Test Market: Successful Technology often Comes from the East"]

[Text] The new German laender have become the test market for environment technology. Two developments have emerged: firstly, more and more eastern companies are settling the fight for survival by clever marketing, suitable partners for production sharing, and innovative environmental know-how. The result: Production sites in the new laender have the latest environment technology which is also talked about in the west. Secondly, more and more companies from the old German laender are making use of the advantages the East has to offer.

Modern Paint Shops

When, for example, the paint shop of the new Opel Works in Eisenach was brought into operation in July 1992, a new age began for automobile finishing. For the first time, water-borne paints are being used in all the paint sectors in an automobile works. The paint shop of the Thuringian works is considered to be the most modern of its kind in the world.

Another example is the 700 million German mark [DM] paper mill belonging to the Haindl group in Schwedt an der Oder. The company, whose registered office is in Augsburg, is staking the success of its fourth production site wholly on recycled paper. Situated right on the Polish border, it is the first paper mill in Germany in which newsprint is produced primarily from waste paper. Not only the annual capacity of 250,000 tonnes but also the environment technology are impressive. The plant uses virtually closed water circuits in production, a chemical-mechanical and a two-stage biological clarification stage, and a modern combined heating and power station for recycling residual materials. The amount of residual effluent is about ten liters per kilogram of paper produced. Haindl claims the energy saving is about 80 percent compared to primary fiber production. An annual figure of 300,000 tonnes of waste paper from Berlin, Brandenburg, and the other eastern German laender are to be treated; even the parent company in Augsburg intends to use the process.

Foron Household Appliances GmbH in Niederschmiedsberg near Chemnitz has also given the competition something to fear in terms of environment technology (see commentary). With its first CFC- and FC-free refrigerator in the world, it has filled a gap in the environment technology market. After the new generation of appliances was presented in April, 80,000 appliances were sold even before production began; the figure will be 150,000 by the end of the year.

Obviously, it is not only the pioneering spirit that is driving the companies in the East towards innovation and commitment. Nowhere else are the investment conditions as good as they are in the new German laender. The industrial investment subsidies from the government, laender, and local authorities, and also the financial participation of the privatization agency in the start-up losses incurred by company purchases and the necessary remedial measures are creating a "entrepreneurial" climate. Rapid approval planning, which those in western Germany can only dream about, underscore these advantages.

The individual regional governments are also endeavoring to support environment technologies. The need for in situ remedial measures and the future requirements in environment technology make this expenditure seem appropriate. The Brandenburg Ministry for Economic Affairs under Minister Hirche, for example, has so far supported the 150 projects in the "Brandenburg Technology Initiative" with funds totalling more than DM35 million.

First Prize for Innovation

Saxony's Environment Minister Vaatz has awarded an "Innovation prize for exceptional achievement in waste avoidance and recycling" for the first time in 1993. In the category of industrial and commercial enterprises, Eilenburg-based Electrolysis and Environment Technology GmbH received first prize for a process for recycling electronic waste. In the future, the peroxodisulphate process will guarantee that circuit boards are processed in an economic and environmentally acceptable way. For the first time, it is possible to collect, sort and subsequently separate out, stage by stage, the metals contained in shredded printed circuit board material. Closed material circuits mean there are virtually no residues to dispose of; in the ideal case, ultra-pure metals such as copper, platinum, solder metal, and even gold are obtained. The patent for the copper recycling process has already been granted.

The east Berlin-based company Wemex has developed a complete treatment plant for electronic waste. The pilot plant with an hourly throughput of 980 kg, which was presented to the public in June, is a world first in its complexity. Ninety-eight percent of the materials contained in the old electric and electronic appliances will be recovered. The use of dry-mechanical processes prevents harmful waste gases, vapours or slurries. High-performance air filters ensure minimal dust emissions. Interested parties from Germany and Europe have already been knocking at the company's door. There is also a production sharing agreement with a Japanese firm.

Good Prospects of Success

A process for cleaning building facades developed by Geo-Profit GmbH, Leipzig, is regarded as particularly worth promoting. The company has developed a mobile system for removing even severe grime, whereby no waste water enters the sewer system. The polluted water is collected and recycled. According to the company, 3,000 liters of water can clean up to 5,000 sq.m. of facade, for which about 40,000 liters are required with conventional processes. The company sees good prospects of success, particularly in view of the immense demand for remedial work in the new German laender.

Moba Dresden GmbH in Freital offers high-tech for the solid waste industry. The company, which stemmed from a research department of the state-owned agricultural machinery firm Progress, has developed a computer-integrated waste disposal system (CAS). "Mawis" (Moba Automatic Waste Identification System) is an identification and clearing system for waste containers. Large-scale use of the system is planned not only in several rural

districts in Saxony, but also in the Lower Saxony rural districts of Wesermarsch and Osterholz-Scharmbeck.

HGN, Hydrogeology GmbH in Nordhausen has an important contribution to make to special projects concerning the clean-up of toxic waste. The newly-developed purification reactor of the Thuringia-based engineering company can be used in situ or as a mobile unit and is suitable for the biological decontamination of small quantities of soil polluted with hydrocarbons. It is economically viable even for small soil loads of around 500 tonnes.

Environment technology of a completely different kind is offered by IAC, Engineering Association for Applied Computer Technology mbH, Leipzig. In October, the software producer intends to bring a highly developed geoinformation system onto the market which will be used for the identification, processing and evaluation of maps, plans of a geographical nature, and infrastructure networks. In view of its new technology, the PC program Polygis/W will also help specialist authorities, planning offices and universities to reduce the costs of cartographic work. Looking at the competition from the old German laender, IAC manager Tischer mentions other advantages: "The program can also be used by a computer novice after a short introduction period, and the users do not need to learn a special programming language."

Lausitz-based Brown Coal GmbH regards itself as being in the vanguard of plastics recycling. With its help, Dual System Germany GmbH, whose credibility has been badly shaken, intends to keep at least some of its promises. The gas works of the Black Pump energy works in Spremberg in Brandenburg are currently being retrofitted by the brown coal and energy company and will then be one of the largest waste recycling plants in Germany. Synthesis gas will be obtained from plastics, waste oil, rubber, and sewage sludge; this gas can in turn be used for the chemical industry.

Largest Sorting Plant

The East has another highlight to offer: Something that ought long to have been standard from an environmental standpoint is at last becoming a reality. Since the summer of this year, the site of Eko Steel AG in Eisenhuettenstadt has not only been the site of the largest German plastics sorting plant operated by Berlin-based Alba GmbH & Co KG. Before long, this site will also be producing, for the first time, garbage bins made of recycled plastics with the cooperation of the garbage container producer Fritz Schaefer GmbH, Neunkirchen. There is no doubt that this will be the starting gun for the spread of "the most typical" of all recycled products throughout Germany. 40,000 containers have already been ordered for the "green spot" in Berlin.

Convincing Proof

The fact that ecology and economics can enter into a close association for the benefit of a market-conscious company has long been proven. Nevertheless, the example of the Saxony-based company Foron GmbH, which came away with the German Environment Association's coveted

Environment prize for 1993 for the first completely CFC and FC-free and hence particularly environmentally acceptable refrigerator, deserves special attention.

It shows that clever management and an industrious workforce, even in a medium-sized enterprise in eastern Germany, can exploit a profitable gap in the market for ecologically acceptable consumer goods. It is merely a matter of identifying these gaps. The sensational success of the "Clean Cooler" by no means fell into Foron's lap. Even in the painfully privatized company that succeeded the combine dkk Scharfenstein, the new beginning was hard work. However, the ambitious ore mountain dwellers did not resort to moaning about the lead other companies had over them; they wanted to be in the lead themselves. And they come up with a highly successful worldwide first. Obviously, not everyone has the luck of the hard worker to have two such powerful midwives as the environmental protection organization Greenpeace and one of the largest German mail order companies to smooth the path to the market. But there is more to it than that. Much more important is the proof provided by Foron that there are definitely opportunities for a medium-sized eastern German company to do business in the field of ecotechnology. Though admittedly, creativity and know-how need to be accompanied by a little optimism.

Switzerland: Progress Made in Construction of Solar Cells

MI2411145993 Munich SUEDEUTSCHE ZEITUNG
in German 21 Oct 93 p 18

[Article by Wolfgang Seemann: "Nanocrystals capture light"]

Photoelectrochemical Solar Cells To Go into Mass Production

[Text] Progress may have been made in the search for environmentally-friendly and cheap solar cells. Michael Graetzel of the Physical Chemistry Institute of the Federal Technical College in Lausanne has succeeded in developing dye-coated titanium dioxide elements which are far simpler to make than conventional silicon solar cells.

Graetzel told an international convention on solar and hydrogen technology in Freising a few weeks ago that the new solar cells are already being used in electronic bathroom scales. They are also used in solar-powered wrist watches, the material replacing the watch-glass. Although the output is only a few microwatts, it is quite sufficient for the watch mechanism.

The starting point for Graetzel's idea was photosynthesis, the photochemical principle used by plants to obtain energy from sunlight. Graetzel's "photoelectrochemical" cell uses a dye to capture light quanta like chlorophyll does in plants. Graetzel found titanium dioxide to be a semiconductor material which transmits the photon charge as electricity in the form of electrons; tests have shown it to be extremely stable.

The essential trick is to roughen the titanium dioxide coating to increase its surface area and thus the number of photons captured. In direct light the new solar cell currently achieves a 10 percent voltage efficiency. Graetzel believes the efficiency can be doubled in the next few years. By comparison, cells made from amorphous silicon, currently the cheapest material, reach an energy efficiency of only around five percent.

In diffuse light, where silicon cells provide hardly any power worth mentioning, the efficiency of the titanium dioxide element is now already around 18 percent. This is chiefly because the titanium dioxide's rough nanocrystalline surface is suited to the spectrum of diffuse (longer wavelength) light. This makes the new technology of interest for applications in our latitudes since the solar cell can provide electricity even with a cloudy sky.

Graetzel describes manufacture as relatively simple, requiring neither high temperatures, vacuum, nor nitrogen pressure chambers. Titanium dioxide can be applied to glass by screen printing. Titanium is also a common natural element, and titanium dioxide is non-toxic, unlike the semiconductors cadmium tellurite and copper indium diselenite, which are also used for solar cells.

Graetzel said that a Gelsenkirchen plate glass firm intends to make 100 watt solar modules. A pilot plant for mass production will be ready there in three years' time. The material is expected to cut the current high costs for solar modules to one tenth.

Germany: Dioxin Emissions in Metallurgical Works

MI2411150893 Munich SUEDEUTSCHE ZEITUNG
in German 21 Oct 93 p 18

[Article by Renate Ell: "Metalworks spew out dioxin"]
[Text]

Experience in Bremen Shows That Plants on the Rhine and Ruhr Could Also Be Cleaned Up

Not all plants in Germany from whose chimneys dioxins stream into the environment are equal before the law. Whilst the Emission Control Order imposes a limit of 0.1 nanograms (millionth of a gram) per cubic meter of waste gas on garbage incineration plants, there are no such rules for other thermal plants such as steel, nonferrous metal or aluminum works. But a single metalworks can emit as great a quantity of dioxins as several garbage incinerators combined.

Dioxins build up in the environment because these chlorinated hydrocarbon composites are very hardly degradable, some of them almost completely nondegradable. They also enter the human body via the food chain. TCDD, often called Seveso dioxin, is the best researched and at the same time the most toxic of the total of 120 different dioxins. It is therefore used as a reference: The total quantity of dioxins and the very similar furanes in a sample is stated in toxicity equivalents (TEQ) and TCDD.

All dioxins have proved toxic in animal experiments and caused cancer and mutations in offspring. The effects on man are known mainly from examinations of the population of Seveso, chemical industry workers, and Vietnam veterans (the defoliant Agent Orange was contaminated with dioxins). Dioxins and furanes occur as unwanted byproducts of reactions involving chlorine, chiefly in thermal processes such as garbage incineration or metal smelting. The contaminants are mainly bound to dust particles.

There is at present little data available on dioxin emissions from metallurgical plants. In recent weeks and months discussion has centered mainly round steel sintering plants, for which the Environment Ministry of North Rhine-Westphalia undertook a measuring program last year.

Sintering plants prepare ore dust for the blast furnace by heating it to 1200 to 1300 degrees together with coke slack, lime, and other additives. At the same time, sintering plants are also used to recycle a wide variety of iron-containing materials, so-called "metallurgist's residues", which make up as much as 30 percent of the sinter mass. But apart from iron and other metals, these materials also contain a large number of other ingredients, including chlorine and hydrocarbons, creating the conditions for the production of dioxins, furanes, and other toxic chlorinated hydrocarbons.

Dioxin concentrations of three to five nanograms TEQ per cubic meter gas were measured in the waste gas from sintering plants. This does not look so shocking at first sight as some garbage incineration plants are also still in this range (although about one half of Germany's 40 plants do now keep within the 0.1 nanogram limit). What makes sintering plants probably the largest single source of dioxins among thermal installations is their high volume of waste gas: About 10 million cubic meters per hour for all German sintering plants taken together. (By comparison, the total waste gas output of all German garbage incineration plants is in the region of 2 million cubic meters.) Thus, German sintering plants give off a total of 200 to 400 grams TEQ dioxins every year. According to environment minister Matthiesen, Krupp-Hoesch Stahl AG's Westphalia works in Dortmund alone gives off 250 grams of dioxin a year. Matthiesen says that the waste gas from the Duisburg copper plant also contains extremely high concentrations of the Seveso poison and in the hot briquetting plant of the Duisburg firm Berzelius Metalworks GmbH peaks of as much as 70 nanograms per cubic meter of air are reached.

Disposal Bottleneck

The theoretically simplest solution to the sintering plant problem would be to keep recycled materials, or at least those containing chlorine, out of the plant. But what would be done with them then? There would immediately be a disposal bottleneck. But in the long term finding alternative means of disposing of some of these materials will be an important aspect of reducing sintering plant emissions. Krupp-Hoesch in Dortmund have already

excluded a particularly suspect material from the sintering process. And North Rhine-Westphalia's Environment Ministry has instructed the labour inspectorate to issue regulations ensuring that no residues from other firms and no materials containing oil are added to the sinter mass.

The ministry and the firm are hoping that a measurement program in November, experimenting with other operating parameters, will give them more information. The authorities and the firm agree that the measurements currently available are insufficient to form a basis for further measures. Krupp-Hoesch also wants to improve the effectiveness of its electrostatic filter by means of so-called continuous precipitation electrodes, but these will not be ready for use until the end of 1994.

They have got a lot further at Kloeckner's steel works in Bremen, where they have been successfully trying to reduce dust emissions for three years. With the financial support of the Federal Environment Office, the firm in August installed a fibrous filter, which has proved very promising, behind its electrostatic filter. The filter is like a sort of large nylon stocking which catches dust and ash. The fabric is coated to make it even more effective at collecting harmful substances: with activated carbon for dioxins and with calcium hydroxide for acid pollutants such as hydrochloric acid. The filter plant is constantly being improved: Emissions will be further reduced next year by waste gas recirculation. The highly contaminated filter dusts are incinerated in the sintering plant; temperatures around 1,200 degrees Celsius also destroy dioxins.

So only approximately two nanograms TEQ of dioxins and furanes now enter the atmosphere in Bremen instead of 5.7 previously. Emissions of polluting dust are also below 10 milligrams per cubic meter, far below the limit applicable from 1.3.1994 under the Air Pollution Control Regulations (50 milligrams per cubic meter); other sintering plants give off between 75 and 200 milligrams. Kloeckner has contractually promised the city of Bremen to reduce emissions to below 1 nanogram TEQ per cubic meter by January 1994 and to reach the 0.1 nanogram per cubic meter limit for garbage incineration plants by the start of 1997. If the firm fails to do so, it is threatened with closure.

With this contract Kloeckner demonstrates that far lower emissions than are now usual are technically possible. In December the laender of Bremen and Lower Saxony will therefore be tabling a motion in the Upper House of Parliament to have corresponding limits prescribed by law for the country as a whole.

Until a generally binding limit is in force, the only basis for action by the authorities can be the minimization principle contained in the Air Pollution Control Regulations. This states that dioxin emissions should be reduced as far as possible. The state of the art is crucial here and it will probably be redefined shortly by the findings from Bremen. Until then it seems that a "lex steel" will apply, or, as Uwe Lahl, state counselor to the Bremen Senator for environmental issues, put it at the international "Dioxin

93" conference a few weeks ago in Vienna: "All emitters are equal, but many are more equal."

Switzerland: Artificial Photosynthesis Process To Cut Solar Energy Cost

BR2411155793 Paris SCIENCES ET Avenir
in French Nov 93 p 7

[Unattributed article: "Artificial Photosynthesis"]

[Text] By artificially reproducing photosynthesis, a process unique to plants, Professor Michael Graetzel of the Federal Polytechnic School in Lausanne may have discovered a promising new process for solar energy. His system should be able to achieve conversion rates comparable to those of silicon-based photovoltaic cells for a manufacturing cost 10 times cheaper!

The chlorophyll is replaced by a thin layer of dye coupled to a semiconductor, titanium dioxide. The photons emitted by the light are absorbed by the dye before "interacting" with the dioxide by displacing electrons from its atoms. These are then directed to a transparent conducting layer. Today laboratory tests yield outputs of over 10 percent. Several German and Swiss companies are very interested in the process. It is true that today, at equal production capacities, the cost of the solar watt is significantly higher than that of one produced by conventional power generating methods.

France to Launch Oil Treatment Consortium

94WS0035C Paris L'USINE NOUVELLE in French
9 Sep 93 p 39

[Article by Jean-Pierre Gaudard: "Environment: New Decree to Be Published Next Month: Used-Oil Recovery Network Being Set Up"—first paragraph is L'USINE NOUVELLE introduction]

[Text] Industrial waste specialists could find new markets. But the collection system must be revised, and treating processes evaluated.

It is now a certainty: Eco-Oils, the consortium that manages the used-lubricant recovery system, will be ready to start operating on 1 March 1994, when the former public system financed by an additional levy will be terminated.

The founders of Eco-Oils, oil companies and independent lubricant manufacturers, have already hired the man who will head the organization, a manager from Elf, and they have chosen premises near those of the Lubricants Professional Committee, in Rueil-Malmaison (Hauts-de-Seine).

The decree reorganizing the oil-recovery system, which was the subject of intense negotiations between professionals and the Environment Ministry, should be published in October. Contrary to a recommendation of the Pietrasanta report that was submitted to the environment minister last December, the incorporation of regenerated oil into lubricants will not become mandatory. The additional levy on lubricant stock produced or imported in France (currently 150 francs [Fr] per ton) will be replaced

by a voluntary contribution from "producers" (whether manufacturers or importers) who will be responsible for what happens to their products. Eco-Oils will probably be the only organization, but it will not have a formal monopoly because, in theory, everyone has the right to collect its own waste. With a budget of close to Fr150 million, the consortium will sign procurement contracts with organizations collecting used oil, and supply contracts with organizations eliminating them.

Will the recasting of the system make it possible for the oil-recovery network to get out of bankruptcy? Everybody hopes so. For the past two years, the crisis has kept getting worse. The expansion of the collection system (the quantities collected rose from 89,000 tons in 1986 to 173,000 tons in 1992) does not make it possible to lower costs, which are estimated to be about Fr500 per ton. At the same time, aging, technological obsolescence, and falling new-oil prices (due to falling crude-oil prices) proved fatal for regeneration units.

Two of them, UEP (in Lorraine) and Solunor (in the Nord), closed down last year. The last plant, CBI, in Seine-Maritime, has been reprieved and survives only by not paying anything for used oil. Overhauling it would require an investment of about Fr300 million, but the unit may be doomed because the process it uses produces tar-containing acid waste.

The reorganization of the collection system, therefore, does not solve all the problems. Simultaneously with the setting up of Eco-Oils, the ADEME [Environment and Energy Management Agency] will order an economic and ecological audit to evaluate various processes of regeneration, energy upgrading (in cement works, EDF [French Electric Power Company] power plants, in fluidized beds with CDF [French Coal Mines]), or recycling in refineries (as catalytic cracker feed or heavy fuel-oil component). This study is causing quite a stir in the small eco-business world, as the Batelle group, through an offer said to be much less costly, hopes to break down the pre-eminence of the Eco-Bilans company on the French market.

The possible construction of an oil-regeneration plant, which might aim to reprocess French lubricants and lubricants from some neighboring markets, will be the occasion of some more tough dealing. This time, the competitors will be major industrial-waste processing companies and the U.S. company Waste Management; the latter's reprocessing plants, which use vacuum distillation technology, have already caught the interest of French technicians.

Germany: Progress in Reducing Chloride Emissions Assessed

94WS0024A Duesseldorf HANDELSBLATT in German
6 Oct 93 p 24

[Article by Christa Friedl under the rubric "Technical Trend": "Chlorine Chemicals Industry/Industry Reports Success in Reduction of Chlorine—By-Product of

Caustic Soda Production. Between Environmental Sin and Sign of Affluence"; first paragraph is an introduction]

[Text] 5 Oct 93 (HANDELSBLATT-TL)—The question of where chlorine cannot be abandoned and where it should be replaced has been fiercely debated for years in Germany. By now critics and industry have come to an agreement on a common formula: Chlorine should be taken out of circulation insofar as possible where it, in the form of products, gets into the environment. Where it is used just as an auxiliary material, it is essential to optimize the processes so that chloride emissions are markedly reduced.

Regardless of the current debate, the chlorine chemicals industry has been in upheaval for years—the abbreviations CFCs, PCPs, PCBs and DDT stand for chemicals that have already disappeared from industry's product range or are shortly facing an end to production because of international agreements or statutory regulations. The consequence is that chlorine production in Germany dropped from 3.5 million tons in 1988 to 2.9 million tons last year, according to the data of the Chemicals Industry Association (VCI).

However, the ban on some substances does not alter the fact that around 60 percent of all chemicals industry products depend on chlorine, either because they themselves contain chlorine—pesticides or agents for textiles, for instance, work only because of the toxic chlorine in the molecule—or because they are produced with the aid of chlorine: For, as an activator, chlorine makes molecules reactive for chemical reaction.

Some Processes Today More Protective of the Environment

Nevertheless, the industry has changed numerous chlorine chemistry processes in the years that have gone by. Some processes are more protective of the environment today than previously at Bayer AG [German Stock Corporation] in Leverkusen, which uses as an auxiliary material for synthesis nearly 90 percent of the chlorine it uses. The production of para-chlorotoluene, for example, an important initial product for pesticides, dyestuffs and pharmaceuticals. The quantity of ortho-chlorotoluene, which results as a by-product in this reaction, was able to be halved from a previous one ton per ton of para-chlorotoluene to one half a ton, by replacing the sulfur in the catalyst by more selective substances.

The chlorine concentration of products can also often be reduced by quite simple measures. One of the latest process changes at Bayer concerns the chlorinated rubber Pergut, an important raw material for the lacquer, varnish and enamel industry. Up to now it had contained an up to eight percent residue of the volatile solvent carbon tetrachloride. The concentration was able to be reduced to below 0.005 percent by an additional purification step in which a chlorine-free substance separates the carbon tetrachloride residue from the liquefied rubber.

Many process improvements are aimed at the hydrochloric acid that results as a fouled by-product in countless processes. For a long time the acid was neutralized and disposed of as a salt with the wastewater. But if the acid is decomposed electrochemically, on the one hand industry reclaims the raw material chlorine, and on the other the pollution load can be reduced. Chemists at Hoechst AG in Frankfurt have developed for their production lines an acid cycle in which the polluted hydrochloric acid is led into an extraction column in counter-current contact with liquid paraffin. Here the paraffin removes the pollutants, and a reusable pure acid and a small quantity of a mixture of chlorinated hydrocarbons is left behind.

Chlorine chemistry is not always the worst alternative. The chlorine option can do even better ecologically in a process comparison. The manufacture of the most important white pigment in the world—titanium dioxide—is an example of this. Highly poisonous dilute acid forms in the sulfate decomposition usually performed, and this acid has for a long time been disposed of by dumping it into the North Sea or by burning it on the high seas. The chloride process has been found to be more protective of the environment here. Six tenths of a ton of ferric chloride forms per ton of pigment here, and it is not dumped but is used as a precipitating agent in wastewater purification. Kronos Titan [Titanium] is producing on average 120,000 tons of white pigment per year in this way instead of 30,000 tons previously. Dow Chemical in Stade is also putting its stakes on the chloride process, but it is not removing the chlorine as a salt, but is using it in the cycle.

Restructuring Completed to a Large Extent

However, the industry's willingness to give up chlorine has its limits. "The restructuring has been completed to a large extent," states Dr. Jan Meerkamp van Emden, acting head of VCI's "Technology and the Environment" department. The reason: Whoever interferes with chlorine chemistry processes is upsetting not only individual production lines but the international network of the chemicals industry with its finely calibrated markets. According to a study by Dr. Walter Schlegel, a staff member of the Stanford Research Institute in Zurich, part of the chlorine is being produced in the first place only because industry uses enormous quantities (over three million tons a year) of caustic soda. Because caustic soda can be produced from common salt—whereby chlorine is also produced automatically—even more advantageously from an energy standpoint than its production from natural soda, there will be no change in this very soon.

Therefore Andreas Ahrens of the Hamburg Institute for Ecology and Policy is calling for the "decoupling of caustic soda and chlorine in order to gain a degree of freedom for further structural changes." Industry's change of course carried out thus far is also still not sufficient for the "Protection of Man and the Environment" study committee in the German Bundestag [lower house of parliament]. It has been busy for a short time primarily with two mass flows from the realm of chlorine chemistry: PVC and propylene oxide. However, in the case of PVC

the opponents and supporters have by now moved toward one another: "PVC exhibits properties like long life, favorable energy balance and numerous recycling possibilities that are also of ecological significance," reads the summary after consultation with experts.

It has still to be shown first whether and how PVC—of which an estimated 12 million tons are presently in use and 400,000 tons per year turn up as waste—can be recycled on a large scale. The business community is in any case planning to design a nationwide recycling system. According to representations by the PVC and the Environment Study Group in Bonn, a 50-km-grid network of recycling stations for old PVC is to be put together by the end of the decade. The construction of a dedicated incinerator has been planned at the same time, in which 250,000 tons of PVC waste per year will be converted to hydrochloric acid and hydrocarbons.

Propylene oxide (PO) has also been able to be produced as a chlorine-free product with definitely better protection of the environment. In Germany 700,000 tons of PO are produced a year by the chlorohydrin process. PO is an important initial product for the commodity plastic polyurethane. The majority of the chlorine used in the process is removed as a salt in the wastewater. The peroxide process used primarily in the USA would be an alternative to this.

A recent study by Prognos AG in Basel concludes that "the replacement of the chlorohydrin process" would be "technically feasible and of great significance from the ecological viewpoint." However, the industry has thus far not been ready for a change, first and foremost because the by-products that would result then are not salable in the market in the opinion of PO producers. What Bayer Vice-President Dr. Dieter Becher recently admitted to journalists in a discussion on chlorine chemistry seems to apply here for propylene oxide too—as for many other chlorine products before: "It is just human for one to say first to begin with that it will not do."

Germany's Largest Wind Energy Device Installed

94WS0085B Frankfurt/Main FRANKFURTER
ALLGEMEINE in German 3 Nov 93 p N3

[Article: "The Largest Wind Converter"; Subheadline: "Aeolus II at Wilhelmshaven / 3 Megawatt output"]

[Text] In mid-October, what is currently Germany's most powerful wind converter was put into operation. The Aeolus II prototype, set up Wilhelmshaven, is designed for three megawatts. Its output is nearly six times as much as the largest standard systems. The tower is 92 meters tall and the diameter of the rotor totals 80 meters. Projected annual energy production is nearly 7.3 gigawatt hours. This is equivalent to the average consumption of almost 2,000 households. The Swedish firm Kvaerner Turbin AB and Messerschmitt-Boelkow-Blohm [MBB] Foerder-und Hebeteknik GmbH in Delmenhorst built the system.

Large wind converters have been growing increasingly popular for some years now. The reason is that the

number of sites with sufficiently high average wind velocities is severely limited. In Germany they are concentrated along the coastal regions and the higher altitudes of low hills. Large converters make better use of such site since they occupy less space than the farms with their numerous small systems. But the technical requirements go up in tandem. As an example, carbon fibers, among other things, were used for Aeolus II's rotor blades. This resulted in a halving of the weight. The extent to which a system is economical, however, also depends on investment costs. The so-called specific costs, the price of a converter divided by its rated output, in the 150-500 kilowatts range, for example, are about DM2,000 per kilowatt hour. It is moot whether this value increases for larger systems.

With support from the European Community, a number of European manufacturers are presently working on bringing systems of approximately one megawatt to the point of serial production readiness. They should be available in 1995. At that time too, it will be determined whether Aeolus II met the expectations placed in it. Operator Preussen Elektra Windkraft Niedersachsen GmbH, Niedersachsen state, the federal ministry for research and technology and the European Community absorbed the costs totaling DM25.5 million. Development of the rotor blades by MBB cost an additional DM6 million.

FACTORY AUTOMATION, ROBOTICS

Advanced Microdrilling Technologies Described

94WS0038A Paris L'USINE NOUVELLE
TECHNOLOGIES in French 9 Sep 93 pp 28-34

[Article by Michel Vilnat: "New Microdrilling Techniques"—first paragraph is L'USINE NOUVELLE TECHNOLOGIES introduction]

[Text] Very-small-diameter drills must now compete with laser, electron beams, and abrasive waterjets... The goal is to improve performance and quality.

Micromechanics, biomedical instruments, office automation, optoelectronics, etc., these new technologies all require new tools. Among them, microdrilling is the subject of numerous developments. The term "micromechanics" covers several technologies that often have nothing in common with traditional drilling which, according to experts, is limited to holes greater than about 1 mm. In fact, below one m, traditional rules concerning machining tolerances or tool shapes no longer apply. For instance, a drill with a 3-mm diameter has a dimensional tolerance equivalent to two thousandths of its diameter (i.e. six microns). Retaining the same ratio for a 0.1-mm drill would mean achieving a precision of 0.2 microns. That is impossible! "The dimensional tolerance of our standard products is 5 microns. Even less if the customer wishes," we were told by production managers at Dixi-4, a Swiss company specialized in small drills.

Microdrilling with high-speed steel drills is widely used, especially in making electronic printed circuits (a mass

application where precision is not very important). On the other hand, to manufacture time-pieces or optical instruments, and in micromechanics, the geometric quality of the hole is a key factor in product quality. Suitable tools are required. To meet this need, Dixi-4 offers a line of one-piece carbide tools (up to 0.1 mm standard minimum diameter) capable of machining stainless steel as well as titanium, even some Inconel alloys. This technique, however, has its limitations. The smaller the diameter, the greater the risk of breakage. Not to mention that tool grinding becomes difficult. In addition, some very hard materials cannot be machined. For all these reasons, experts have looked for other means to achieve the same result.

Electric Discharge Machining [EDM] Makes a Niche for Itself

EDM works by generating a spark between an electrode and the workpiece, both of which are immersed in an insulating (kerosene type) liquid. The electric discharge melts the material over a very small area. Simultaneously, the higher temperature causes a microexplosion and expels the molten metal. Thus, a series of sparks will progressively bore into the workpiece. The Swiss company Charmilles Technologies developed a system based on this principle; it can drill holes to a minimum diameter of about 10 microns! The system consists of two complementary pieces of equipment. The first one, EDM EL-10, is used to cut electrodes; the second one, EDM HO-10, uses these electrodes to drill holes. Visitors at the World Machine-Tool Show, held this month in Hanover, can see these machines at the Swiss manufacturer's booth. On the EL-10, a small round bar of tungsten, the diameter of which is to be reduced progressively by EDM, is placed in a ceramic chuck rotating at 3,000 rpm. This type of machining uses a brass wire (acting as an electrode) that moves on a pulley and progressively becomes tangent to the tungsten bar. This makes it possible to achieve very small diameters without generating stresses. When the bar has been machined down to the desired size (very slightly smaller than that of the hole to be made), it is placed on the second machine, which also uses EDM. This will drill into the hardest materials (provided they are electrical conductors) with considerable precision (q 2.5 microns) and a remarkable surface finish (0.1-micron Ra roughness). These are highly-rated characteristics, especially when making micro-injectors (for ink, gas, or fuel) or the dies used to make textile fibers. One original application involves making electric-bulb filaments. It is now possible to replace the very expensive dies made of polycrystalline diamond with tungsten-carbide dies in which 12-micron-diameter holes are drilled! This method, however, has its limitations: the hole depth must not exceed 10 times its diameter, and the drilling speed is relatively slow (about 2 minutes per hole).

This low productivity may prove a handicap in certain fields, especially in aeronautics, where thousands of holes have to be drilled in aircraft body components and in engine parts. For this, lasers represent an interesting alternative. In particular solid (YAG [yttrium-aluminum

garnet]) lasers. The Lumonics company, for instance, has set up several high-speed hole-drilling facilities, both in France (in particular at SNECMA [National Company for Aircraft Engine Study and Manufacturing]) and abroad (Rolls Royce, McDonnell Douglas, etc.). Depending on the application, two processes can be used. The first one involves percussion. In this case, the beam remains fixed long enough to generate a series of more or less numerous pulses to drill the hole. McDonnell-Douglas, for instance, uses this method to drill holes about 0.01 mm in diameter in a titanium foil 0.08 mm thick. Based on these first tests, the U.S. manufacturer developed this method as an alternative to electron beams to drill aircraft wing and body components. These holes, 30-micron in diameter, are designed to generate surface laminar flows and reduce the aircraft drag. Laser drilling has also been used for medical equipment (for instance hypodermic needles), and to make very fine metallic filters for the agrifood industry.

Laser can also work through trepanning. In this case, the laser beam drills a hole by describing a circle. This technique is used to make deep holes (0.2 to 1 mm in diameter) in vanes and combustion chambers, and in timing covers. The drilling rate can be as high as 30 holes per second. In the United States, car manufacturers use the same method to drill cavities one mm in diameter and 18 mm deep in engine connecting rods; each cavity takes five seconds. Compared with percussion, trepanning is more precise. For instance, in the case of a connecting rod, the taper is less than 16 percent.

As far as lasers are concerned, the CO₂ laser, too, is an interesting tool. It becomes still more interesting in the laser milling machines (Lasercav) developed by the German manufacturer Maho. Lasercav works somewhat like EDM: heated to a very high temperature, the material is either sublimated, or melted, while a gaseous mixture of oxygen and air under pressure blows away the residues. Compared with a laser beam alone, Lasercav offers several advantages. The workpiece edges are cleaner (with a laser beam used in the traditional way, a crater forms at the hole entrance), and the hole geometry is closer to a cylinder than to a cone. Yet, the working speed remains high. Actually, "laser milling combines two technologies on a single machine. For instance, to drill holes, the operation starts with a (laser) milling cycle and ends with a high-power laser pulse. We thus obtain calibrated holes 100 microns in diameter and several millimeters deep, with very clean edges," we were told by Rolf-J. Ahlers, R&D manager at Rauschenberger, an automotive subcontractor. This process has made it possible, for instance, to drill holes in a part designed to channel the air flow used to drive a small turbine. Note that Maho engineers have already modified their machine to meet the requirements of a Singapore company specialized in aeronautics. In this case, a YAG laser (which delivers more energy per pulse) will replace the CO₂ laser to drill more rapidly the cooling holes of turbine vanes made of refractory alloy.

Excimers represent the third type of laser source used to drill holes. These lasers emit beams in the ultraviolet range, contrary to CO₂ and YAG lasers which work in the

infrared range. Thus, their wavelength is much shorter and the energy delivered by the beam much higher. As a result, the radiation does not work through fusion, but through photo-ablation. In this case, molecular bonds are broken and the material is, in a way, vaporized. This makes for perfectly clean hole edges. To illustrate the efficiency and precision of excimer lasers, Lumonics experts drilled a multitude of through-holes into a human hair (outside diameter: 60 microns) without burning it. It takes an ultraviolet laser beam to achieve such a performance. At industrial level, the first applications are to be found especially in the electronic industry, for silicon micromachining. At Siemens, in Germany, a dedicated line of several lasers is used to drill Kapton, an insulator used in making integrated circuit boards. The hole geometry is far more precise than that obtained with a YAG or CO₂ laser.

Among microdrilling processes, the prize for high-speed operation goes to the high-energy electron beam. This process also covers a broader range of diameters and depths than lasers. That is not surprising considering that the energy at the focal point is about 100 times greater than that required for welding. Messer Griesheim has developed a facility for the aircraft industry which, among other things, can drill millions of 50-micron holes in stainless steel sheets at a rate of up to 3,000 holes per second! The beam starts melting the metal at the impact point and all the way to a bottom layer (containing apatite or silicon mixed with tin powder), which explodes when it comes into contact with the electron beam, ejecting the molten metal. This way, hole edges are not sharp. In addition, the remelting effect on the walls is insignificant. On the other hand, the entrance diameter is two to two and a half times larger than the exit diameter. This process was also used by SNECMA on ceramic materials. However, it has two major drawbacks that considerably reduce its range of application: the workpiece must be held under vacuum, and it must be accessible on both sides so that the bottom layer can be deposited. So far, the aircraft industry is the only one to possess pilot plants.

Some materials are both very hard, electrically non-conductive, and highly sensitive to thermal shocks. Quartz is one of them. This material, which is used in particular in resonators and sensors, required the development of a specific technique: ultrasonic micromachining. Free abrasive particles are brought by a carrier fluid (usually water) under a vibrating tool (the sound-electrode) which projects them onto the surface to be machined. The sound-electrode progressively copies its own shape by pushing itself into the workpiece. The frequency of the vibrations that drive it ranges between 20 and 40 kHz. The material-removal process is the result of three phenomena that occur simultaneously. When the particle size is smaller than the gap between the tool and the workpiece, the abrasive particles are projected onto the workpiece with huge acceleration rates (up to 750,000 meters/second²). If, however, the particle size is greater than the gap, chip removal occurs through hammering. In the other mode, machining results from the erosion generated by liquid cavitation (the implosion of gas bubbles

sticking to solid surfaces). Among the abrasives used, boron carbide is one of the most productive, but it will not yield a good surface finish. The material-removal rate can be as high as 30 mm³ per minute on quartz and 77 mm³ per minute on glass. For its part, silicon carbide provides greater precision. Although it is relatively slow and requires time-consuming tool adjustment, ultrasonic machining is nevertheless an industrial process that is used regularly to cut resonators out of quartz.

Abrasive waterjets are known for their cutting efficiency, but they can also be used for drilling. The Swiss company Carlota has developed a special head that can make cavities with a minimum diameter as small as 0.2 mm. It includes a sapphire nozzle that concentrates the waterjet into a mixing chamber (Venturi system) where the abrasive is placed. Then, a hard-metal guide-tube channels the abrasive-carrying water. The diameter of the tube determines that of the hole which, however, will be tapered. Nevertheless, if the diameter required is greater than 0.2 mm, it is possible to straighten out the hole sides by modifying the nozzle orientation and making it follow a circular path; in that case, the hole obtained is almost round. This technique is interesting for deep drilling into hard materials. It is still in the development stage, and much progress still remains to be done, especially with respect to guide tubes. Its first applications involve drilling and cutting enamelled watch dials. It takes three minutes to do what used to require eight hours of manual work!

Plasma Technik Develops Advanced Plasma Torch

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TECHNOLOGIES in French 9 Sep 93 p 86

[Article by Michel Vilnat: "Revolutionary Plasma Torch"—first paragraph is L'USINE NOUVELLE TECHNOLOGIES introduction]

[Text] This new system, using a torch rotating at up to 200 rpm, can treat bores several meters long and with diameters ranging from 35 to 500 mm.

Traditionally, treating the surface of bores with a plasma torch requires rotating the parts around the torch. Today, with the Rotaplasma-500 of Plasma Technik, the problem is solved: it is the torch that rotates at up to 200 rpm.

The device makes it possible to treat bores, even very long ones (several meters), with diameters ranging from 35 to 500 mm. All that is required, is to mount at the end of the Rotaplasma-500 any of the inner torches used until now in a fixed position.

The thickness of the deposit is accurate to 0.01 mm. In order to allow optimum adjustment of the projection distance, it is possible to vary the angle of deviation between the main axis of the torch and the rotation axis.

The Rotaplasma-500 will make it possible, in particular, to treat the inside of car engine cylinders. Jean-Paul Langagne, the Plasma Technik chief executive officer,

explained: "The Rotaplasma is a tool just like a traditional torch. Thus, it may perfectly well be mounted at the end of a robot arm and connected to an existing system."

Better still, the Rotaplasma can be coupled to the M-500-T mobile projection system to treat parts on location. In particular, to deposit brazing metal on large-size exchangers.

The main problems to solve had to do with the passage of powders (grain sizes ranging from 5 to 80 microns, depending on the type) and water under pressure (14 bars) through a rotating joint. As for the electric power, it is carried through a copper braid routed inside the coolant lines. Considerable care was also given to electrical insulation, as the current intensity can be as high as 500 amperes.

Italy's Cad Lab Develops New CAD Software

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TECHNOLOGIES in French 9 Sep 93 p 86

[Article by Philippe Beauflis: "Eureka, a Super CAD [Computer-Aided Design] Modeler"—first paragraph is L'USINE NOUVELLE TECHNOLOGIES introduction]

[Text] The latest introduction of Cad Lab, this NMT [non-manifold technology]-generation software offers a unique structure for geometric data, whether as lines, surfaces, or solids.

Mark these barbaric-sounding words: "Non Manifold Topology" (NMT). These three words express the new mathematical and geometric foundations of the next CAD-modeler generation. Eureka, from the Cad Lab company, is one of them. A leading Italian supplier of CAD programs for workstations and personal computers, Cad Lab achieved a significant technological leap back in 1991 when it acquired a small high-tech company, Eco Cad.

The new modeler that resulted, Eureka, integrates in a single core various representations (as solids, surfaces, or lines) of the objects being designed, a two-dimensional "variational sketcher," interactive parameterization, and the creation of "feature" forms. This means a lot of features for a modeler that aims to be ideal.

The NMT approach offers a unique structure for geometric data, whether as lines, surfaces or solids. With a click of the mouse, the user can change a surface into a solid, or cut across a solid along a skewed surface. Boolean operations (union, subtraction, etc.) can now be performed both on three-dimensional and on two-dimensional models.

In addition to its ease of use, which makes it unnecessary to have recourse to several types of CAD software depending on the type of object one wants to design, this technology makes it possible to work on partially-defined composite objects with an open structure. The operator can thus focus on other parts of the project without finalizing the previous part right away.

In the near future, Eureka could benefit from the drawing-preparation capabilities that made the reputation of Cad Lab's DraftMaker software. It will also be connected to two machining and finite-element meshing modules, Eureka CAM [computer-aided manufacturing] and Eureka FEM [finite-element modeling]. A mesh generator using the P-element method will be integrated into Eureka, which is available for use on IBM, HP, and DEC workstations, and soon for Sun and SGI [Silicon Graphics] workstations.

Hanover Fair to Showcase Advanced Machine Tools

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TECHNOLOGIES in French 9 Sep 93 pp 14-20

[Article by Michel Vilnat: "More Precise and Productive Machine Tools"; first paragraph is L'USINE NOUVELLE TECHNOLOGIES introduction]

[Text] Every machine tool maker in the business is pursuing the micron—and even the nanometer. Boosting productivity, notably through cutting-assistance techniques, has not been forgotten either.

Like all equipment suppliers, machine tool manufacturers have been hit full force by the recession. Their engineering and design offices, however, have not been idle. The 10th International Machine Tools Show (IMTS), which will take place in Hanover in late September, will display the products of their innovation. No fewer than 1,800 exhibitors from 36 countries will be on hand to unveil their latest inventions. Most brandnames share a concern for improving precision. And whether a maker of lathes, milling machines, or grinders, every manufacturer in the business is pursuing the micron. Some are even "flirting" with nanometers (one-thousandth of a micron). Consequently, although not yet widely used, nanomachining, as the specialists call it, should experience sharp growth.

The German firm Kugler is one of the leaders in the race to achieve exquisite precision, and will unveil the first, single-point machine tool specialized in the production of hard material pieces (glass, and especially steel) at the IMTS show. The machine produces a geometrically perfect surface by moving a tool that makes occasional contact with a piece, eliminating the need for grinding and polishing. Automakers are especially interested in using the process to grind light-alloy cylinder heads with steel inserts. To achieve a high degree of precision (an Ra roughness measurement of a few nanometers on glass lenses, for instance), Kugler engineers devised some original techniques, including a cutter bar with hemispherical bearings and hydrostatic journal bearings combined with traveling wave motors. This "fully hydraulic" system will be able to make mechanical pieces, for it tolerates substantial cutting forces.

Kugler, which is also the top manufacturer of laser mirrors in Europe, is no neophyte. Last year the firm devised a prototype that can also machine hard steels, and that employs a different system for guiding the tool-holder, dubbed Hydro-Air. Pressurized air raises the tool carriage,

while a hydraulic bearing provides side guidance. The marriage of the two technologies offers many advantages. To start with, Hydro-Air is much stiffer than rival "fully pneumatic" devices, which cannot work hard materials. Moreover, it travels at high speeds (up to 2,500 mm/min) over a considerable distance (up to 2,500 mm). Its resolution is 10 nm on 1,800 mm. "At this level, you are closer to very high precision than to real nanomachining. But it is a niche that meets more industrial needs than nanometric scale [machining] does," says Lothar Kugler, the company's founder. Hydro-Air's cost, which is 40-percent lower than "fully hydraulic" devices, makes it even likelier that it will penetrate the industry. Grinders are by definition already very precise machines, and are also tackling nanomachining. One example is the FFGM 1000, designed and built by the British firm Cranfield Precision Engineering Ltd. The machine grinds to within one nanometer, and can work ceramics, glasses, or glass ceramics of ordinary shapes to surface smoothnesses of 1 to 2 nm Ra. The FFGM 1000 owes its performance to its numerical control system, the Cuproc 3000, which guarantees zero contouring error. But a special grinding system, christened Elid (Electrolytic In-Process Dressing) also helps. Elid employs electrolysis to dress the cast-iron matrix grinding wheel, which is studded with diamond or cubic boron nitride (CBN) particles. The electrochemical process oxidizes the surface of the grinding wheel, drowning the abrasive particles in the ferrous oxide (which is constantly regenerated during the operation) and preventing them from scoring the surface of the piece.

Some of these special machines' technical solutions are also found on more conventional equipment. One example in particular is Granitan, used for the FFGM 1000's frame. Granitan is produced by mixing aggregates of selected granites with an epoxide resin. The composite has a very low thermal dilatation coefficient (10.5×10^{-6} mm/degrees C), and a very low elasticity modulus (30kN/mm²). Even better, it is only one third as dense as cast iron! Consequently, Granitan is highly stable dimensionally, largely thermally inert, and absorbs vibrations quite well. Renault adopted it for its ETD 220, a horizontal lathe that combines precision with relatively low cost. But Granitan is not the only "exotic" material to offer attractive characteristics. Traub Sonim company, for instance, makes its machine frames out of concrete.

CO₂-Laser-Assisted Machining...

Engineering and design offices are not concerned solely with precision; economic constraints being what they are, boosting productivity is also a major focus. One of the methods being explored—high-speed machining—is making regular strides. But engineers still need to develop suitable tools before it can be used on hard materials.

Another path to enhance productivity involves methods to aid in machining. The first brainstorm engineers had was relatively simple: "If we can't boost the tool's performance, let's try reducing the local characteristics of the material." Using this approach, technicians need "only" heat the material beyond a certain temperature at which its mechanical characteristics start to deteriorate. "Lasers

are the only way to provide a sufficient quantity of focused and controlled heat at the chip/piece shear area," explains Jean-Paul Longuemar, professor at the Ecole centrale. Though it seems a simple idea, executing it is much less so. Indeed, the material must be heated enough to "soften" it just where it is to be machined, without melting it, since melting would make it difficult to clear away the chips. Most important, the heat must not affect the sublayer. "With proper adjustments, we reduced cutting forces 60 percent, and penetration forces 70 percent, in hardened steel." Gains on exotic materials, he stresses, are currently "about 30 percent." What is more, the laser has other beneficial effects, namely improved surface smoothness. "In some case, roughness even drops by half," adds Jean-Paul Longuemar.

But machining-assistance methods do more than improve finishing. The Central Technical Weapons Establishment (ETCA) is working on rough machining, and has a high-powered CO₂ laser (22 kW) that gives it access to a great deal of energy. For the time being, the Arcueil specialists are primarily interested in titanium, which is always difficult to work using conventional methods. Initial results show an approximately 25-percent reduction in cutting forces. It is worth mentioning briefly that the Arcueil facility is conducting milling-assistance tests using the same principle; however, since the surface areas worked are greater, the laser must be more powerful.

Via YAG Laser...or Water Jet

IREPA in Strasbourg and FIPT in Aix-la-Chapelle are exploring another option. The Strasbourg researchers are experimenting with a 1-kW pulsed YAG from BMI able to deliver 50 kW at peak powers. Right now mirrors are transporting the beam, which limits its output. "Initial tests with the mirrors device did not produce very good results on steels; forces decreased by only an estimated 10 percent," explain IREPA staff. And a 10-percent gain is obviously not industrially profitable for steel. However, as Jean-Paul Gaufillet, IREPA engineer, explains, "The use of new optical fibers that can tolerate peak powers of 30 kW will enable manufacturers to place the beam exactly where desired, which will make the YAG more valuable again." Moreover, the new generation of 2-kW continuous YAGs able to operate in pseudo-continuous mode raises new possibilities. In contrast, the Germans at Aix-la-Chapelle's FIPT achieved excellent results on ceramic pieces. Ceramics, like silicon nitride, absorb laser radiation very well. "It is becoming possible to turn ceramics on a lathe with CBN or polycrystalline diamond tools. Up until now, those pieces had to be grind-machined," stresses Jean-Paul Gaufillet. And that is just a start. Researchers are currently working on modeling beam/material and tool/piece interactions, and on viscoplastic phenomena. Moreover, all these studies are part of a BRITE/EURAM program involving a dozen European partners.

ENSAM in Paris is working on an aid technique using very-high-pressure water jets. Initial tests were conducted with pure water injected at 3,800 bars. The water cools the major cutting edge, promotes fragmentation of the chip,

and creates a sort of hydrostatic journal bearing between the tool and the chip (friction drops dramatically). As a result, cutting force and tool wear drop. The first tests used 4 to 5 liters of water a minute at 3,800 bars, and a water jet about one mm in diameter. "This assistance method makes it possible to at least double—and in some cases decuple—the life of the tool, or to boost productivity," says Alain Cornier, head of ENSAM's production, research, and development department. "However, more than pressure, it is the shape and flow rate of the liquid that seem crucial. We are preparing a round of tests where the pressure will be set at about 800 bars. The basic parameter is the cooling of the tool's major cutting edge," stresses Cornier. Indeed, the more poorly the machined materials conduct heat, the better the results. The availability of new single-stage pumps will reduce pressure, but flow rates will easily increase tenfold. Single-stage pump architecture makes it possible to use water combined with a soluble oil, which is presently not feasible with very-high-pressure systems.

The Japanese have taken this approach—which boosts flow rate and reduces pressure—even farther. Like Mitsui Seiki's High-Jet, a machining center is equipped with a pressurized, numerically-controlled spray device (unlike the lathe system, the jet can change direction). The technique reportedly triples the life of a standard tool used for deep machining of hard steels. Operating pressure is limited to 69 bars, but flow speed exceeds 60 liters/min. Saeilo Machinery is offering the Flojet, a lathe spray device that mixes cutting fluid and a liquid cooled by CO₂.

Although machine technology has evolved enormously, cutting tools have also made great strides. New coatings have lengthened the lives of tools and cutting tips. The best known of these coatings is titanium nitride, which combines extreme hardness with a very low friction coefficient. TN coating is undergoing some changes: Manufacturers are either combining it with carbon to obtain carbonitride, or with aluminum or zirconium.

"Diamond" Tools

Still more powerful are boron carbide deposits, which quadruple the life of a tool working inox compared to the same tool coated with titanium nitride (already a high-performance coating).

Substantial development of amorphous diamond carbon is also underway. Several French companies such as Carbionic Systeme, ICMC, or ACM are carrying out ADC treatments in vacuum ovens. Indeed, ADC coatings offer several advantages, including a high degree of hardness (from 3,000 to 6,000 HV), and a friction coefficient less than that of Teflon. This latter trait makes the chips slide more easily. Moreover, ADC coatings conduct heat better than copper. However, it is not always easy to make ADC adhere well to substrates, and the diamond carbon layer is averse to high temperatures.

A thin layer of pure diamond is an even harder material. The first inserts of diamond-coated matrixed carbide are expected to be out on the market within a year or two.

However, for physical chemistry reasons, diamond cannot be used to machine steel. For steels, CBNs (cubic boron nitride) are all the rage, and their use should become more widespread when machine-tool makers are able to produce large runs of CBN monocrystals.

French Firm Develops Innovative Digital Servocontrol

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[Article by Thierry Lucas: "Numerical Controls Become Computers"; first paragraph is L'USINE NOUVELLE TECHNOLOGIES introduction]

[Text] New-generation numerical controls are incorporating the latest high-tech devices such as DSP, 64-bit microprocessors, and flash memories. They are even merging with PCs. Their objectives: speed, precision, ergonomics, and programming help.

Ever since computerized numerical control invaded shop floors a good 20 years ago, the technology has constantly had to rise to new challenges. Machine tool users, whether working in traditional machine, aeronautics, or cutting-edge industries such as optics, demand ever more powerful performance. This has prompted control manufacturers to turn to electronic components and the latest computer techniques.

Once run through "wired" logic devices, numerical controls are now real computers, with 32-bit (and even 64-bit) microprocessors, high-capacity hard disks, "flash" memories, signal processors (DSP), and more. No means of bringing the full power and flexibility of top-of-the-line computing to the production floor has been overlooked. Manufacturers are focusing on two main issues: product performance, of course, but also ease of implementation and programming. This last criterion is decisive for both machine manufacturers and factory users.

The performance expected of computerized numerical controls can be summed up in two words: speed and precision. The ultimate accomplishment, obviously, is to combine the two.

Achieving both is the stated goal of 32-bit microprocessor controls, such as Siemens's Sinumerik 840 C and 880. To illustrate the difference these processors make, when Siemens upgraded from a 16-bit to a 32-bit processor, the Sinumerik 880 was able to process a block of instructions in 12, instead of 40, ms. Siemens has installed a 386 processor and a 387 math coprocessor into its latest models. Indeed, computing trajectories, coordinating axes, and continuously adjusting tool paths during machining requires powerful number-crunching ability. In fact, a top-of-the-line numerical control tool such as the Sinumerik 880 can contain as many as four CPUs. In addition to two 386/387 boards controlling up to 30 axes, one processor controls the man/machine interface, while another concentrates exclusively on outside communications (network, computer, etc.). However, Siemens's middle-of-the-line 840C can be tailored right now for "high

speed" machining, simply by replacing the 386 with a 486 processor. The switch slashes processing time for an instruction block from 16 to 6 ms.

The processing capability of a numerical control tool naturally has a direct bearing on how long it takes to manufacture a piece, and consequently, on the machine's productivity. But the precision and quality of machining are just as important. Indeed, one of the major headaches in numerical control is eliminating (or reducing) "contouring error." Briefly, that means constantly correcting the inevitable gap between theoretical speed and position instructions and the parameters actually measured on the machine during machining. The more rapid the machining, the harder this error is to correct—hence the need to limit high-speed machining to avoid imprecision in the piece's geometry or rough surfaces that will require additional reworking (grinding). "The solution is to optimize the interaction between the control and the process underway and, better yet, anticipate the machine's reactions," explains Jean-Luc Gely, marketing director at Num.

Escalating Performances

That is the approach the Telemecanique subsidiary took in developing its new numerical servocontrol architecture, Disc (Digital Integrated Servo Control). Disc integrates the speed-variation function that controls the motors of the machine's axes into the control computer. The function actually consists of an electronic card with a DSP (digital signal processor) that connects directly to the numerical control bus. For machine manufacturers, this translates into simpler and less costly integration. But Disc architecture also aims to provide the end user with greater machining precision and better stability at low speeds.

To take the whole thing further still, Num has embarked on another major innovation, dubbed adaptive numerical control. In plain English, this means taking into account the physical characteristics of each machine (axial inertia, friction, etc.) to enhance machining precision. The process begins when the numerical control is integrated into the machine tool. Num has begun to offer controls that can learn automatically, by incorporating the machine's parameters, using software based on fuzzy logic. This learning function should make both initial adjustment and on-site maintenance much easier. Predictive algorithms will subsequently be able to use the machine-specific database to anticipate how axes will react during machining and to correct the control accordingly. "Adaptive numerical control should enable us to eliminate contouring error, even at high speeds," says Jean-Luc Gely.

At the Hanover International Machine Tools Show, Num will offer its new 1060 numerical control tool in two configurations. Series 1 features three 32-bit Motorola processors and a four-axis DSP per group (maximum of 32 axes). Series 2 brings the architecture down to the middle of the line, with a main Motorola processor and two DSPs (maximum of eight axes).

GE-Fanuc, the industry's world leader, is obviously not sitting out this trend toward increased performance. The American-Japanese manufacturer has been updating all its lines since the beginning of the year. All of its products now contain 32-bit microprocessors—Intel 386s on the 18 (4 axes) and 16 (8 axes) series, and Motorolas on the top-of-the-line 15 series (a maximum of 24 axes). "The series 15's 'high-speed' version, which has two microprocessors, can calculate blocks in as little as 500 microseconds," says Jean-Marc Joly, commercial engineer at GE-Fanuc. The model is also designed for very high precision machining, at less than one micron, a level that is already being called "nanomachining."

For the most demanding users, particularly die makers, GE-Fanuc offers the option of adding a 64-bit microprocessor to the 15 and 16 series. With this architecture, the main processor computes the blocks, while the 64-bit chip is dedicated to controlling trajectories during machining. Manufacturers use this very-top-of-the-line configuration to make tire-side molds, for instance, or to produce aspherical eyeglass lenses.

"Users demand performance and technological innovation," says Jean-Luc Gely of Num. "But the widespread use of computerized numerical controls on the shop floor has always run up against problems in the adjustment of operators, who are competent machinists, but are unfamiliar with programming techniques. Today, the progress in data-processing makes it possible to substantially enhance the ergonomics of numerical control." Num will present its new programming interface, which it developed in collaboration with a firm specializing in educational software for technical fields, at the IMTS. The interface emphasizes an interactive approach to programming using graphical tools. As with a CAD program, the operator outlines the contour of the piece and enters the machining parameters (material, tool, etc.). There his job ends, as the numerical control automatically elaborates the rest of the program.

GE-Fanuc offers two levels of programming assistance. The software available for the bottom and middle-of-the-line models (series 18 and 16) requires the operator to graphically sketch out the machining process on the screen by plotting the tool's path. At that point, the NC calculates the parameters automatically, and can simulate the process on the screen. Operators receive more help from the top-of-the-line 15 series. The 15's numerical controls use the finished contour of the piece to be machined plus a rough shape (several standard models can be stored in memory) to come up with a machining operations sequence that the operator can validate.

For many people, computer friendliness is synonymous with personal computers and the user comfort offered by the new Windows-type graphical interfaces. So manufacturers are now adopting a radical solution: They are merging the PC and numerical control worlds. At Num, this concept has given birth to the PCNC, presented for the first time at the IMTS. The PCNC is available for the entire 1060 line, and integrates a PC486 board (which comes with the OS/2 multitask operating system) with the

numerical control card, both of which connect to a VME bus. "The computerized numerical control still controls the machining, but the PC facilitates the development of application software using tools available on the market," explains Jean-Luc Gely. Num's PCNC targets manufacturers of special machines, who need to devise specific programs. But it also affects final users of the machine, since the PC environment can be used to create new man/machine interfaces, maintenance-assistance tools, expert systems, and so on.

Allen-Bradley had the same idea. Its series 10 is also tackling the market for special machines, which require personalized interfaces and application software. Its models are built around a PC/AT bus, which users can connect to a PC386 board. Siemens has integrated a PC into its Sinumerik 840C, to introduce its concept of "in-shop programming" into milling work. Here again, the process is based on the interactive input of the geometrical features of the piece to be machined. After input is complete, the system offers a sequence of operations which the machinist can validate. Generation of the program to be executed by the control is automatic.

Wood-Working Machines Get in the Act As Well

All these tools to facilitate the programming and work of operators also seek to boost machine productivity. As a consequence, numerical control is no longer reserved to the manufacture of long runs, but can also be adapted perfectly well to single-unit production.

Limited runs are typical of wood-working machines which—although requiring performances that match those of metal-machining centers—feature much shorter, and often single-unit, production cycles.

Such constraints are only likely to stimulate the inventiveness of numerical control suppliers. This is especially true since the rate at which manufacturers are acquiring numerically-controlled wood-working machines is still growing—a rare phenomenon in today's economy.

France: Latest Renault High Productivity Automobile Plant Presented

94WS0041A Paris INDUSTRIES ET TECHNIQUES
in French 10 Sep 93 pp 76-78

[Article by Thierry Mahe: "Three Billion Francs [Fr] Invested in the Douai Automobile Plant; Renault's Future Model Plant"—first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] This plant prepares the transition between the Renault-19 and its successor, in 1995. Every workshop in the plant has been entirely rethought to increase productivity; but they do not rely solely on automation.

The Renault plant in Douai—renamed the Georges Besse Plant at the end of June—is destined to become the manufacturer's most productive plant within two years. Three billion francs were invested to support that ambition. In Douai, Renault wants to match the best Japanese

transplants in Europe. One indicator explains and quantifies this approach: the IMVP index developed by the MIT (Massachusetts Institute of Technology) provides a nearly universal evaluation of an automobile manufacturing cycle time, whether in Europe, in the United States, or in Japan. In Douai, the indicator reads 29 hours. The objective is to reduce that figure to 20 hours. Why entrust that leader's role to the Douai plant? Because it will soon end production of the R19, and series production of its successor (code named X64) is scheduled to start only in 1995. This transition period is the right time for an in-depth restructuring of the industrial tool. Some mutations are quite spectacular, for example the construction of a state-of-the-art "paint priming" shop (which alone will cost Fr1 billion), or the purchase of a stamping press worth Fr300 million. Others amount to a recasting of existing facilities. The transfer press will be delivered in January 1994; the paint shop is at the running-in stage; most of the restructuring of sheetmetal and assembly lines was done in August. In brief, the metamorphosis of the plant is practically completed: production of the X64 will start more than one year from now, on fully broken-in equipment.

For the stamping shop, the outstanding event is the installation of a 5,400-ton transfer press from Hitachi. The equivalent of five presses put end-to-end, it can stamp either several small parts at a rapid rate, or a single very long part, for instance the one-piece side of the X64 body. Transfer technology offers many advantages. The cost of maintenance is low—no conveyors or prehensile robots between presses—and the surrounding noise is down to less than 50 dB because these presses operate in a tunnel. On the other hand, this equipment requires fine adjustments. Hence the precaution of breaking in the press for one year on the R19. Another innovation is that, starting after the holidays, the stamping shop will be piloted by the plant central production department. It is one link in the "just-in-time" strategy. The first maintenance level is provided by production teams, through a weekly inspection. At the end of the line, parts are inspected by sight and by touch and then by means of templates or three-dimensional feelers. A small innovation concerning quality: When a body contains stamping defects, it is returned to the shop where workers diagnose the defect themselves.

The sheetmetal workshop is experiencing its own revolution. The objective is twofold: to shorten the overall cycle time and to reduce inventories... This workshop is one of Renault's former jewels, typical of Renault wild years. A record 98 percent of the operations are performed by robots! "Obviously, if we were to redesign these facilities, there would be much fewer robots," Fabrice Bouchez, head of the sheetmetal process-planning department, noted. Laid out over two floors, the shop has an architecture in islands: assembly of body sides, front ends, floors, opening parts, general assembly (body in white). The front-end assembly (35 parts assembled by 335 welding spots) is fully automated. Another small masterpiece of robotics, the "overall capacity assembly mill" assembles the front end, the rear end, and the top of the R19 at the

same island, irrespective of options! To do so, it uses up to six sets of tools. These marvels will be retained, of course. They will just be disassembled and reassembled at another location. Actually, the entire workshop topology is being redesigned. It is a guarantee of flexibility and time savings. This "move" will be done in two stages: the first one ending in August 1993, during the annual plant closing; the second one, one year later.

The installation of the "paint priming" hall was something of a feat: much of the equipment was set up even before the building was completed. At present, production teams are actively working on pre-series under the supervision of Michel Riou, of the Renault central process-planning department, and Jacques Raisin, of the Douai paint department. Since June, a carousel of R19 bodies has been going round in this giant 350-meter tunnel. It will be ready by September.

These facilities are built to last at least 20 years. This is why Renault anticipated forthcoming European regulations concerning the discharge of waste into water (by reducing solvent and eliminating chromium use) and into the atmosphere (by installing a fume incinerator). In particular, the workshop can be adapted to use water-soluble paints (see Glossary). Non-stop operation will make up for the nominal capacity reduction. As a result, automation is pushed to the utmost and the entire surface-treatment shop is now controlled from a general supervision station. To ensure that absolutely no particle is left on car bodies, these are rinsed by immersion rather than mere spraying, at every stage of the surface treatment. Another noteworthy innovation is that, here, process-planning engineers use low-temperature cataphoresis (see Glossary). Michel Riou pointed out: "The temperature is lowered from 200°C to 160°C, so that car bodies can include plastic components." Body turnover is much faster than it used to be: 95 per hour instead of 60 before. In addition, body handling has been improved: First, bodies are hung automatically; then, they hang from side arms rather than from a central fastener; that means less grease and dust falling down.

The assembly hall, too, has been entirely rethought. Even the assembly sequence was revised, and some operations "compacted." For instance, sun roof installation will become part of the "automated trim section." Robotics is being developed here and there, for instance to apply cement to mirrors and install them; this will start after the summer holidays. All these changes are part of a strategy aimed at bringing together at a single independent site tasks that until now were dispersed. Eventually, this should improve work organization, give added responsibilities to the personnel and, of course, save time and improve quality. Another consequence of this "compacting" is a gain of surface area. Until now, the lower level of the assembly hall was devoted to mechanical parts assembly, the second to trim installation. In the new assembly strategy, the mechanical section will move upstairs, between second-level operations. For instance, the seats will now be installed after the power train. Finishing and testing will remain on the lower floor. But

test drives are a thing of the past! Each outgoing vehicle will be tested on a roller bench.

Glossary

- **Transfer press:** It is a single machine equipped with all the stamping tools (dies, punches, etc.) available on a press line. At each stroke, each tool works on a part. The parts are transferred automatically from tool to tool. Such a press can be used to accelerate the stamping of small parts or to stamp a very long part in several stages.
- **Paint priming:** It consists of a body degreasing and phosphate-treatment stage, followed by a cataphoresis stage. The former takes place in a surface-treatment tunnel where the body, hanging from a conveyor, undergoes various immersions and sprayings. Cataphoresis deposits the very first paint layer by electrodeposition. It is followed by a curing treatment.
- **Water-soluble (or water-phase) paint:** It is an efficient and environmentally sound solution to protect metals. In this paint, water replaces solvents detrimental to the environment. During drying, the water evaporates, allowing the resin and pigment particles to agglomerate irreversibly.

Stamping

Investment: Fr300 million.

The stamping workshop will employ 700 people working in three eight-hour shifts. It will be equipped with 100 presses and 700 tools. Starting in January, the plant will house a 5,400-ton transfer press (see Glossary) designed by Hitachi (tooling supplied by Honda Tools). It will be set into service in July 1994. This press will be able to stamp body parts up to 3.8 meters long (among others, a one-piece half-body). It will perform up to seven campaign changes per day, with a very short tool-changing time: five minutes!

The Fr300 million include civil engineering work designed to reinforce the basement.

Sheet Metal-Iron Work

Partial recasting during August 1993.

This shop is representative of the time when Renault automated everything. Robotization achieved record performance: 98 percent! Here, 1,100 people working in two eight-hour shifts and 250 robots assemble 320 parts requiring 3,400 welding spots. The entire shop topology will be restructured. From a common trunk—the sheet-metal shop (common, except for a few exceptions such as ironwork which is performed simultaneously on two lines, one of which is manual)—two half-plants operating in parallel will branch out. The restructuring will be completed in two stages: the first one in August (during the annual factory closing); the second one, one year later.

Priming Prior to Painting

Investment: close to Fr1 billion.

Everything is new in the paint priming (surface treatment) hall: the building, the equipment, even the process used. It

is scheduled to be set into service in September 1993. Renault anticipated forthcoming regulations on waste discharge. The plant capacity was increased to 95 vehicles per hour, instead of two lines of 60 vehicles per hours each. The deficit is offset by around-the-clock operation. This means extensive automation. Cataphoresis is performed at low temperature (160°C instead of 200°C) so that plastic components can be included in the bodies.

Assembly

Tasks will be reorganized starting in August 1993.

The assembly hall is being restructured in order to bring together, at an independent location, tasks that until now were dispersed. This should lead to time and space savings and improved quality. The sequence of certain tasks is being reconsidered. For instance, an automated section will include installation of the roof and the dashboard. Similarly, sun roof installation will be added to the trim section; seats will be installed after the power train. Robotics is being developed here and there, for instance to apply cement to mirrors and install them. Finished vehicles will be tested on a roller bench instead of on a test track.

Labor Relations

- During the second half of 1992, when R19 production reached record levels (1,400 vehicles per day), all employees agreed to work 30 minutes more every day. The workdays thus accumulated (14 at the start of 1993) make it possible to avoid layoffs and dismissals now that production has dropped by 20 percent. Other Renault plants are imitating this agreement.
- In 1992, training accounted for 5.25 percent of total wages. Under the Optimum plan, one third of operators are expected to reach the P2 [second vocational level] skill level by the end of 1993.
- In Douai, a ratio of three suggestions per year per person has been reached. Guy Bara, the plant manager, pointed out: "In 1992, 15,000 suggestions were submitted, one half of which were approved. We cannot go much further with great principles. People must now implement their own ideas."
- According to Patricia Fouache, communications manager: "Sometimes, we stop the lines—which is a sacrilege in the automobile industry!—to bring the personnel together and discuss important subjects: qualifications, the automobile sector crisis, etc. Once, a manager brought in competing vehicles to praise their good points!"

EC: Machine-Tool Developments at Hanover Exhibit Presented

94WS0041B Paris INDUSTRIES ET TECHNIQUES in French 10 Sep 93 pp 87, 88

[Article by Mirel Scherer: "From Very-High-Speed Machining to Laser Cutting: Hanover Surprises"—first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] In spite of the slump, the European Machine-Tool Show [EMO] will not run out of innovations.

This year, the EMO is held in Hanover, in a sullen atmosphere, to say the least. Actually, because of the economic crisis, investments are declining in all industrialized countries, and the machine-tool sector is especially hard hit. This, however, does not put a brake on the manufacturer's determination to innovate and improve their equipment. High-speed machining, deep drilling, numeric controls metamorphosed into personal computers, new sheetmetal machining equipment, etc. You can still look forward to many surprises in Germany.

Hard-Metal High-Speed Machining

Recently acquired by SFPI, the BMO [Brisard Machine-Tools] group, through its many subsidiaries (Forest Line Capdenac, Forest Line Albert, Berthiez, Rene Clement, etc.), will display its milling, turning, and drilling know-how. The pioneer of very-high-speed machining (UTGV) in France, Forest-Line has been working on the subject at its Capdenac plant for 15 years. It is now offering solutions suitable for every type of material. Its Umac-5 and Minumac machines will machine many soft or composite materials. Minumac, like the brand new VMAX, can even machine hard metals. "Very-high-speed technology represents a veritable mother lode of productivity and quality because, for a given material, you can achieve cutting speeds five to 10 times greater than with traditional approaches," Pierre Tillement, the Capdenac plant manager, estimated. Speeds of the order of 500 to 1,500 rpm can now be used to machine hard metals such as cast iron or matrix steels (using carbide tools coated with cermet, ceramic and cubic boron nitride, or CBN). However, these "very-high-speed milling machines" are subject to several major constraints, such as tool-path accuracy and dimensional and dynamic stability. They also require very high spindle speeds (up to 30,000 rpm). Numeric controls, in this case, play a key part: they must provide a very short sampling time, rapid instruction-block processing, and high-resolution axis piloting. Note that special machinery expert Rene Clement will demonstrate his deep-drilling knowhow at the Hanover show.

Personal Computers Take Over Numeric Control

One of the major innovations of the EMO will probably be the control system introduced by Num. "The PCNC [personal-computer numeric control] concept symbolizes the merger between the PC and NC worlds," Jean-Luc Gely, product and marketing manager at Num, explained. Actually, it is not just a matter of integrating a PC board into the NC cabinet; rather, the entire NC design has to be revised. Available on the entire Num-1060 range of numeric controls, this concept allows the NC to manage the process (closed-loop control of the machine axes and management of its programmable controllers), while the PC takes care of both user's applications (man-machine interface, computer-aided maintenance tools, software and tool management) and manufacturer's applications (computer-aided design and manufacturing, machine monitoring). A real-time dialogue interface will exchange,

read, and write an infinity of objects, parameters, and variables between the two entities of the new control. Compatible with Windows (the Microsoft graphic interface), PCNC supports all trade applications developed under MS-Dos. A veritable gold mine for users...

Measuring Made Easy

The inventor of the first measuring robot, the Italian manufacturer DEA [Digital Electronic Automation], is still pursuing the same objectives: to provide users with efficient and easy-to-use control systems. For instance, its new software, Tutor for Windows, used with a proprietary data processing and management system, will handle any metrological application. It can also perform an automatic scanning of skewed surfaces. User-friendly, it will run in multiwindow mode and it comes with over 100 preprogrammed cycles, a tutorial, and a large library of application software. Using the computer-aided design tools bundled with it, users can even generate part drawings and display measurement results directly on the PC screen.

Lower Machining Costs Thanks to New Cutting Tools

Sandvik Coromant has developed a complete set of carbide inserts, cutting tools, and tooling systems for turning, milling, and drilling. Their main objective is to reduce machining costs and improve machine-tool quality and productivity. Example: the GC-4025 supergrade for turning and drilling, and inserts that can be previewed at its EMO booth. The company will also present its original shallow-hole drill concept and its modular Coromant Capto tooling system. The latter includes driven tools, clamping devices, adapters, and cutting devices. It could not fail to include data-processing for cutting tool management: this is achieved by the new software Mini-Tas for Windows. The Intelli-Tool modular sensors will be there to monitor tools on machining centers.

Computers to Determine How Much Metal Remains to Be Machined

Delcam International is putting the final touch to its CAM (computer-aided manufacturing) software, named Duct, which offers several new functions. It aims to provide users with the best possible machining strategy, to optimize metal removal, and to reduce to a bare minimum or even eliminate manual finishing. But the most significant development is that which allows users to know, for each tool, how much metal remains to be machined. This approach paves the way for a machine-time reduction of about 20 percent.

Electronic Bending Machine for Large-Diameter Tubing

Bending has few secrets for the Italian company Pedrazzoli. All the same, this manufacturer just outdid itself by developing a machine that will premiere at the EMO. It can cold-bend steel tubes with diameters up to 168 mm, thicknesses up to 6.5 mm, and lengths up to 5,000 mm. Its secret: An electronic control system manages all machine functions (including analysis-diagnostic) and memorizes bending programs.

CAM: a Must for Quality Machining

At the EMO, several French companies will exhibit their latest developments in the field of CAM. Sapex, for instance, will show its Pam'X software which can handle parametric machining. The slightest change in a geometric element automatically entails a corresponding modification of its machining. The company has other interesting products in its bag, such as Silex, a dedicated software program for tool management and distribution; or Pilot X, a workshop-monitoring software package that should prove very useful to companies wishing to obtain Iso-9002 certification.

Alma, a specialist of CAD/CAM [computer aided design and manufacturing] software for sheetmetal cutting will present the latest improvements in its leading Rimbaud software, as well as Geopunch (punching-machine programming), Manege (cutting workshop management), and Ritmo (cutting optimization).

Machining All Kinds of Sheetmetal

The machines of the Belgian company LVD include the most advanced technologies available for sheetmetal work: laser cutting center, bending presses provided with synchronized sheetmetal supports, with hydraulic crowning or bottom actuators, etc. All these machines are equipped with a 32-bit numeric control that can simulate three-dimensional machining. The company also announced a world premiere in the field of bending, but it will unveil it only at its booth.

What You Will Not See at the EMO Show...

Partners for better or for worse, Cazeneuve, Ernault, and Somab are among the latest surviving French machine-tool manufacturers. In view of the disastrous climate that currently prevails in the industry, their decision not to exhibit at the EMO will surprise no one. The expense of going there was deemed too high. Too bad, because it was not the fear of technological confrontation that prevented them from exhibiting. The machines they offer have nothing to envy to those of other manufacturers.

Cazeneuve, well known for its traditional lathes, has also adopted numeric controls. Advantages obtained: rapid series changes, precision, improved productivity. Its latest lathe, the CT-200R equipped with a rework spindle, makes it possible to finish a part with a single clamping. Cazeneuve also innovates in milling: its DB-Univer milling machine is equipped with an original numeric control developed jointly with Num: It allows programming through learning.

Designer and manufacturer of all-purpose or numeric-control lathes and multifunction turning centers, Somab adopted the same approach. The Optimab-400 lathe equipped with a 32-bit Num-1060 NC also offers programming through learning. The lathe operator/tool dresser can use this function to program the machining of a prototype part or first part of a series, and then apply it to the other parts. As for the Polymab-SP multifunction center, it is a single machine that includes the functions of a two or three-axis lathe and those of a three-axis vertical

machining center. As a result, the operator can perform successive and combined turning (internal or external), boring, milling, drilling, and tapping operations in a single run.

The latest troika member, Ernault, contributed the high-end machines that were lacking in its new partners' catalogs. The Twin family of twin-spindle turning centers with six-axis revolving tools counts a new addition, the 320-M. It offers the same advantages as previous models: reduced investment and labor costs, smaller footprint, improved productivity and machining precision. It also offers the same clever technological features: beds made of Granitan (polymer concrete) providing high rigidity (the amplitude of machining vibrations is divided by three), powerful spindle motors (15 to 22 kilowatts), efficient chip/chip time (1.5 s), high axis-speed (24 meters per minute), and 32-bit numeric control.

LASERS, SENSORS, OPTICS

Netherlands: Philips Develops 1.1-Angstrom Microscope to Analyze Atomic Nuclei

BR101114793 Rijswijk POLYTECHNISCH
WEEKBLAD in Dutch 15 Oct 93 p 3

[Article by Rene Raaijmakers: "Philips Electron Microscope With Resolution Below Two Angstrom"]

[Text] Acht—Philips has taken a giant step forward in materials research by drastically improving the resolution of the transmission electron microscope (TEM). Through progress made in the field of electron sources and electro-optics and the application of smart computing algorithms, it is now possible to discern atomic nuclei at 1.15-angstrom (0.115 billionths of a meter) resolution. That is approximately the diameter of the smallest atom, hydrogen.

The move from two angstrom to one is roughly equivalent to changing from using an ordinary one-day train ticket to an annual public transportation pass. The number of directions from which the structure of a material can be looked at have drastically increased. The possibilities for materials research have increased and the chances of successfully looking into a sample are higher. The developments taking place at Philips are part of the BRITE-EURAM [Basic Research in Industrial Technologies for Europe/European Research in Advanced Materials] project called "Subangstrom Characterization," in which various European research institutes have been involved.

Increasingly more technologies require sharp boundary layers between materials. Quantum-well layers in semiconductor lasers, for instance, are only a few atoms thick. Many kinds of multilayer structures, from materials for magneto-optic recording to magnetic sensors and microelectronics, have optimal properties when boundary layers have atomic-scale sharpness. This development makes it essential to carry out the analysis with atomic precision.

The extraordinary thing about a transmission electronic microscope is that the instrument is able to look into the

material on an atomic scale. That gives the instrument an unassailable position in materials laboratories. Other scanning microscopes, such as the scanning tunneling microscope (STM), the power microscope (AFM [atomic force microscope]), or the scanning electron microscope (SEM), are only able to make a record of the surface, while the best resolution they achieve is always around two angstroms.

Slide Projector

A transmission electron microscope magnifies the rows of atoms in a microscopic specimen in the same way in which a projector shows a slide on a screen. Source-generated electrons are accelerated by applying a high voltage and send through the crystal; a number of magnetic lenses (the electron optics) display the reflecting electromagnetic waves onto a fluorescent screen or CCD [charge coupled device] camera (a kind of video camera). A row of atoms along which the TEM is looking appears as a small spot in the picture. However, a TEM is only able to make such a picture when the rows of atoms lie further apart from each other than the resolution.

It is true that using the TEM, crystal structures could until recently be made visible as far down as the atom, but this was only possible in very limited directions. In silicon, for instance, with a two angstrom resolution, TEM is able to look only along one crystal line. This phenomenon can be compared to a Venetian blind which can only be seen through when the viewer takes up the right position with regard to the position of the slats. "As a result of the improved resolution, it is now possible to see in five or six different directions in silicon," says Dr. Frans Greidanus, group leader for structural analysis at the Philips Physics Laboratory. "As a result, a scanning direction can be found much faster than before. In principle, the construction of a three-dimensional atomic picture is within reach. We have not yet got to that point, but in principle it is now possible."

Lens Constitutes Limitation

The wavelength in an electron microscope is 100,000 times smaller than in a light microscope, but the resolution is only 1,000 times better. The limiting factor is the spherical aberration (deformation) in the magnetic lenses, which is always positive. It means that a magnetic lens is always stronger for beams hitting the edges than for those hitting the center. No correction can be made for this spherical aberration, and it is therefore not possible to obtain a better resolution than 1.9 angstroms with transmission electron microscopes which have an accelerating voltage of from 200 to 300 kilovolts.

"The limitation of the TEM is in the lenses," says Marc de Jong of Philips Industrial Electronics. "We are coming up against a very difficult limit. We will never reach a resolution of 1.8 angstrom using electron microscopy with an accelerating voltage of 200 kilovolts; we are stuck at 1.9 angstrom."

Philips Electron Optics BV in Acht has now succeeded in reaching this minimal aberration. In addition a very

regular (coherent) electron light source, 1,000 times clearer than the tungsten wire normally used in TEM's, has been developed in Aht. The resolution does remain limited due to the spherical aberration in the magnetic lenses, but the coherent radiation ensures that the electron waves which are deformed by the lenses do contain usable information. With the help of smart computing programs, this hidden information can be used in order to recreate a picture with a much better resolution. First of all, a CCD camera makes digital pictures at different focus angles. Powerful computer software uses this information to construct an atomic-level picture within a quarter of an hour. The pictures immediately display the positions of the various atoms. Until recently, mainframes required several days to compute atom positions, even with pictures with better resolutions.

First TEM Ordered

Natlab [Physics Laboratory] researcher Wim Coene and Guido Janssen published this breakthrough together with the University of Antwerp (RUCA) in December 1992 in the reputable magazine *PHYSICAL REVIEW LETTERS*. A resolution of 1.4 angstrom was obtained by applying Coene's computing methods to a 2.4-angstrom-resolution TEM.

A resolution of 1.1 angstrom was recently achieved by improving the hardware of a very advanced piece of equipment at Philips Electron Optics. Natlab itself has already ordered a TEM with this resolution from Aht. It will cost 3 million guilders. Is Philips at the forefront in TEM development with this equipment? According to Greidanus: "Yes, I dare say that without any doubt. I think we have always been trailblazers in electron microscopy. We are about to reach the limits of TEM. Perhaps we can still come down to just under the angstrom, but that is really as far as it will be possible to go."

Germany: Biosensor Detects Formaldehyde

MI2311100193 Bonn *TECHNOLOGIE-NACHRICHTEN*
MINIUMAGEMENT-INFORMATIONEN in German
15 Oct 93 pp 18-19

[Text] The first-ever pocket devices for measuring the concentration of glucose (blood sugar) and lactate (lactic acid) were developed in Germany and came onto the market at the beginning of the year, and now the breakthrough for user-friendly miniaturized biosensor devices has been made in environment monitoring too, with the formaldehyde detector developed by Draegerwerk AG. An air pollutant detector will come onto the market before the end of the current year in the shape of the highly sensitive "Bio-Check F" pocket meter, which is based on biomolecular detection principles. Unlike conventional metering methods, which are so complicated that they can only be applied by specialists and are laboratory-dependent, this device can be used easily, rapidly, and anywhere by anyone, and is also reasonably priced. This will encourage widespread use in the interests of improving health and environmental protection.

The main factors that had to be guaranteed in developing a reliable system that private individuals could use to measure the formaldehyde concentration in the air indoors were high sensitivity, easy use, and low production costs. An indicator surface on the "Bio-Check F" changes color from white through pink to red, and comparison with a color-code strip shows whether the formaldehyde concentration in the air is below the maximum recommended indoor level, is equal to it, or exceeds it. It is thus just as easy to use as, for example, an alcohol level test for drivers. The new detector also brings the cost of formaldehyde measurement way below (to less than a third of) that of the laboratory process needed to date.

Formaldehyde is widely used as a basic ingredient for synthetic resins. The gas, which in its pure form is colorless and gives off a pungent smell, is used in the production of amino plastics and phenolic plastics, which in turn are ingredients of products such as adhesives, synthetic foams, insulating materials, floor coverings, and textiles (which it renders crease-resistant). If formaldehyde is released by the glues used in furniture, wall coverings, and chipboard, or by furnishing fabrics, it can cause discomfort or even, in higher concentrations, constitute a health hazard. The Federal Health Authority therefore recommends 0.1 ppm (parts per million) as the threshold value for air quality assessment purposes in the home, in schools, and in other indoor environments. In other words, the formaldehyde concentration ought not to exceed one 10⁻⁶ millionth by volume, for example 0.1 milliliter per cubic meter.

The new measuring system is enzyme-based. These biological catalysts make it possible to single out and register only the substance to be measured. To perform the measurement, the system is activated by pressing the base of a phial in the measuring device with the thumb, thus breaking it. The liquid thus released flows into a small, permeable, sintered glass rod, where it activates the freeze-dried enzymes and the reagents. Of the molecules that diffuse over the surface of the glass rod, the only ones converted are those "recognized" by the enzyme contained there (formaldehyde dehydrogenase). As a result, pigment molecules form on the surface of the rod. The color change that takes place after two hours can be evaluated using a color comparison strip.

Further details are available from the BEO [Biology, Energy, and Ecology] Project Manager, Berlin Regional Office, Federal Ministry of Research and Technology, Hannoversche Str. 30, D-10115 Berlin, tel. 030-39981327, fax 030-39981318.

MICROELECTRONICS

France's IMD Develops High-Resolution IC Test

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TECHNOLOGIES in French 9 Sep 93 p 85

[Article by Jean-Yves Catherin: "High-Resolution Printed-Circuit Tester"—first paragraph is *L'USINE NOUVELLE* *TECHNOLOGIES* introduction]

[Text] Thanks to a new method used to read electrical data from printed circuits being checked, the IMD company offers a system with a resolution that can be as high as 0.2 mm.

To test printed circuits, manufacturers generally use "nail beds." But these systems have resolutions that currently do not exceed 0.635 mm, whereas some circuits have a 0.5-mm or even 0.3-mm pitch. To solve this problem, the Grenoble company IMD has developed a method to read electrical data from printed circuits which has a resolution of up to 0.2 mm. The company offers a standard Puzzle board designed to interface locally the fine-pitch tracks of the circuit being tested with a nail bed having a pitch greater than 1.27 mm. "Using CAD [computer-aided design] data," Christophe Vaucher, product manager at IMD, explained, "software separates the traditional test points, which are easily accessible through traditional means, from the complex points corresponding to very-fine-pitch tracks, which are connected to the nail bed through a Puzzle board. The board blows up the tight initial architecture (presented on one side) into a new spatial arrangement on the other side, with a pitch greater than 1.27 mm. Puzzle boards are stuck to a very fine elastomer strip which contains a multitude of micro-wires enabling them to be conductive through the thickness (test current), but insulating in the plane, and to achieve a very reliable interconnection with the product being tested. They are mounted on a thin epoxy film that has been perforated at the same time as the specific nail-bed board. Currently used for interconnections and providing some 10 industrial pitches, Puzzle boards are "catalog" products sold at very low cost. The IMD company, which currently offers software for existing testers, will soon offer a complete tester.

United Kingdom: Chip for 2.5-Gbit SONET Transmission Systems Designed

BR1011170293 Chichester INTERNATIONAL TELECOMMUNICATIONS INTELLIGENCE in English 18 Oct 93 p 7

[Unattributed article: "United Kingdom - Single Chip SDH 2.5Gbit/s Cross Connect"]

[Text] A small UK company has designed a complete set of semiconductor integrated circuits that together can make a complete multiplexer-demultiplexer and cross connect system for use with 2.54Gbit/s STM-16 synchronous digital hierarchy (SDH) or SONET [synchronous optical network] transmission systems.

Swindon Silicon Systems Ltd (SSSL) designed the nine chips as its contribution to a project funded under the European Commission RACE advanced communications research and development programme to develop a very high capacity optical network (HCON) for customer premises.

SSSL Director, Clive Bunney, explained to International Telecommunications International [ITI] that the project is led by the British Broadcasting Corporation, and is capable of handling data at an aggregate rate of 40Gbit/s.

He said that a prototype system has already been built to prove the practicality of the project, and with new funding under the second phase of the RACE programme, a complete demonstration system is now under construction.

Bunney said that the HCON uses a wave division multiplex (WDM) technique, where lightwaves at 16 different wavelengths are carried in a single optical fibre strand. Each lightwave has a bandwidth of four nanometres and carries data at the SDH STM-16 rate of 2.54GHz. SSSL's chips have the task of multiplexing, demultiplexing, switching and conditioning electronic signals before and after they are converted to and from their optical form.

Bunney told ITI that the SSSL chips will be made available on the open market during the last quarter of 1993 and first quarter of 1994. Samples and evaluation prototypes of five of the chips are available now.

The list of functions is impressive. They include input and output buffer chips, 2.5GHz multiplexer and demultiplexer, and STM-1 clock recovery circuit, a byte multiplexer, a STM-16 to STM-1 demultiplexer that splits out data streams contained with a 2.54Gbit/s channel into 16 data streams each at 155Mbit/s, and an STM-1 adapter. But the most significant device is a 12 x 12 switching matrix, virtually a full 2.54Gbit/s cross connect core on a single chip.

Bunney says that the switch is fully non-blocking and can pass a full bandwidth 2.5Gbit/s data stream from any input to any combination of the 12 output ports. "Bigger switches can be made simply by adding more chips," he said. Thus a 48 x 48 port cross point switch matrix can be built by interconnecting 16 of the chips.

Germany: Contaminant Microanalyzer Developed for Multiple Applications

94W/S0058A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 5 Oct 93 p 8

[Article by OEL: "Contaminant Analyzer in Microformat Developed; Monitoring of Waterways; Areas of 4 Square Centimeters; Work on More Microsystems"]

[Text] Frankfurt—For several years the Karlsruhe Nuclear Research Center (KfK) has been working on the advanced development of microsystems technology, a technology that operates with microelectronic production methods to produce complexly developed "intelligent" devices a few micrometers in size. In the opinion of the research center, this involves interesting fields of operation for small and medium-sized German industrial firms as concerns new instruments for measuring and control systems, medical technology, environment, housing, and communications technologies, as well as transport. Tiny devices are being developed for medical technology which, in the form of microendoscopes, get all the way into small blood vessels and can carry out so-called minimally invasive surgical procedures or diagnoses in them directly on or even in organs. The research center

sees its mission in connection with this to be the joint elaboration of production methods and the demonstration of the nature and scope of new kinds of microsystems with examples.

On the occasion of a status colloquium held in Karlsruhe at the end of September for German and European microsystems experts, they were able to demonstrate a new kind of microanalysis system as a pollutant analyzer for the monitoring of water, waterways, or rivers. The microsystem is accommodated on a 2 x 2-cm area and laid out in such a way that it continuously picks up water samples and feeds them into a basin in which specific chemicals can be identified and classified by means of a tiny spectrometer. The spectral composition of the light changes depending on the nature or composition of the pollutants. Even very small traces can be detected with this reliable optical analysis technique.

Designed as a lattice spectrometer, the spectrometer is only 6 x 8 mm in size. Changes in color are captured over a diode line and transformed into electrical signals which can then be analyzed by a microcontroller. The micromasuring system can also be equipped with additional specifically designed chemical sensors, depending on which purpose it is to be used for. The many different accessory mechanically operating pumps, chambers, and valves can hardly be seen with the naked eye.

There is a team of scientists and engineers at the KfK specifically organized for microsystems technology who work on the perfecting of prototypes a few micrometers in size of large turbines, electric motors, valves, or pumps. Furthermore, those materials that are best suited to the purpose are studied by them and the production methods perfected. Microsystems technology has long since gotten past the phase of purely experimental developments. As demonstrated by the pollutant analyzer, useful and helpful devices for many fields of application can be produced with this technology. For additional information: Karlsruhe Nuclear Research Center, Ltd., PMT Project, D-76021 Karlsruhe.

JESSI: ASICs Developed for Small, Medium German Firms

94WS0058D Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 11 Oct 93 p 10

[Article: "Custom-Made Chips for Small and Medium-Sized Companies; Promotion Through European JESSI Technology Program"]

[Text] Erlangen (DPA)—One hundred small and medium-sized firms in Germany are already using the European technology program, JESSI (Joint European Submicron Silicon), and are having a chip developed for their production. These so-called ASICs [application-specific integrated circuits]—chips for special customer requirements—constitute a great opportunity for small and medium-sized industries in Europe. Dieter Seitzer of the Erlangen Fraunhofer Institute for Integrated Circuits said at a specialists conference in Erlangen.

As examples of this, Seitzer cited an electronic guidance system for buses, a special television system for an opinion polling institute, or an "electronic jogging shoe" that measures the distance run with an ultrasonic radar device. There are broad areas of application for ASICs in the mechanical engineering industry, for example, or in the toy industry. According to Seitzer, some 25,000 firms throughout Europe could take advantage of the development services of 15 application centers. He said that firms in Scandinavia and Germany are the farthest advanced in the use of ASICs, while Southern Europe has been lagging behind up to now. It would take between DM10,000 and DM100,000 to develop a chip that could also be produced for several users.

According to Seitzer, there are about DM6 million a year available for firms' access to microelectronics within the framework of the JESSI program, half of which comes from the federal budget. The other half is obtained through projects in four German application centers. JESSI will continue to operate until the end of 1996. Scandinavian countries and Switzerland are also participating in it along with six EC countries. While the annual research program budget amounts to about DM700 million, barely DM4 million are budgeted in all of Europe for the firm use program.

NUCLEAR R&D

Germany: Nuclear Fusion Research Expanded in Greifswald

M12311101493 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 15 Oct 93 pp 5-6

[Text] The BMFT [Federal Ministry of Research and Technology] is supporting the expansion of Greifswald as a scientific and research center through institutional and project funding to the tune of 11 million German marks [DM] this year. The recently founded Institute of Low-Temperature Plasma Physics is receiving about DM4 million, the University of Greifswald about DM6 million, and the Technology and Entrepreneurs' Center about DM1 million. The Greifswald region would experience a major boom if it proved possible to build a fusion center there, said Federal Research Minister Dr. Krueger. He intended backing Greifswald in its effort to become an attractive location for international fusion projects as well. Europe, the United States, Japan, and Russia are currently working together on the design for an international thermonuclear experimental reactor, ITER for short. In view of the preliminary scientific work accomplished and German scientific expertise in fusion research, the Federal Government put in an early bid to host ITER.

The BMFT is currently planning for Germany to propose the Greifswald/Lubmin site to host ITER. A final decision on the location for ITER is not due before 1998, however, so a start could not be made on building until 1998 at the very earliest. It is estimated that ITER will take about

seven years to build. The chances of the bid being successful are not all that great, as numerous other countries have applied as well.

To give Greifswald any chance at all in the bidding for ITER, the site must urgently be expanded into a fusion research center. The BMFT has thus already asked the Max Planck Society to look into the feasibility of setting up an institute or a division of an existing institute there. The requisite procedure has already been set in motion through the senate planning committee. Should it bear fruit, the basis for fusion research in Greifswald would be created.

The nuclear fusion research capability in Greifswald would have to be built up in such a way that the center would remain viable even if Germany were unsuccessful with its bid for ITER.

However, building Greifswald up to form a fusion center will require a great deal of effort from all concerned, the BMFT not being the only party involved. A major prerequisite for attracting ITER to Germany would be a broad political consensus on the issue, to which the blessing of the SPD [Social Democratic Party of Germany] would have to be obtained. This is necessary both to lay the legal foundation and to complete the subsequent licensing procedure. Federal Research Minister Dr. Krueger welcomed the support that the land parliament of Mecklenburg-Western Pomerania had promised for ITER and the region's commitment to the issue as a member of the ITER Promotion Association. He said that he regarded the medium- and long-term infrastructural development of Greifswald as a potential fusion center as a matter of priority. This will require:

- negotiations to be held with the Trust Agency to arrange the release of the site envisaged for ITER in Lubmin;
- housing, schools, and hospitals to be built;
- adequate power supplies to be laid on;
- the area to be covered in the Federal Transport Route Plan; this would involve planning expanded Federal Railway services (e.g., intercity express links) and a feasibility study for an airport, and
- adequate data links to European centers.

A decision in favor of Greifswald as the location for the fusion center would undoubtedly also have an impact on the training capacity that the technical and vocational colleges in the area would have to provide.

If Greifswald were successful in its bid for ITER, the international project would then have a site already geared to fusion research as its home. Should Greifswald fail in its bid, it would nevertheless have a good chance of hosting the next European experiment, which could well be the W VII-X stellarator.

CERN to Decide on Hadron Collider's Future

94W50081D Paris AFP SCIENCES in French
23 Sep 93 pp 20, 21

[Article: "CERN Should Decide on Construction of LHC Sometime Next Year"]

[Text] Geneva—Despite the crisis, while CERN (European Particle Physics Laboratory) should decide on the construction of its next particle accelerator during the next few months, the similar American project may be permanently scrapped. The permanent Large Hadron Collider (LHC) project, to be built in a tunnel 27 km in circumference straddling the Franco-Swiss border and which already houses the LEP (Large Electron-Proton Collider), will be the subject of an extensive presentation before the European organization's board of directors next December. It could be adopted at a special meeting "sometime next year, probably in April," the future director of CERN, Mr. Christopher Llewelyn Smith, indicated to a group of reporters on 21 September.

Elected last year for three years, on 1 January Mr. Smith (UK) is to succeed Pr. Carlo Rubbia, a Nobel prize winner in 1984 and director since 1989. On the same date former French Minister of Space Research Hubert Curien will assume his duties as chairman of the board of the organization, replacing Sir William Mitchell (UK).

It is estimated that the LHC will cost Fr8 billion and that running the two experiments retained for the proton collision study, ATLAS and CMS (Compact Muon Solenoid), will cost all told 3.2 billion over eight years.

The CERN executives appear to be confident despite the economic difficulties. The future director stated that he has "not studied any alternative solutions" for the LHC project and felt that it meets the two conditions that have been imposed: It must be a machine capable of making basic discoveries with a relatively extensive research program.

The LHC should make it possible to confirm or invalidate the "standard, ultimate constituents" of matter model, which have not yet been observed—the top quark (the sixth and last) and Higgs' hypothetical boson—or perhaps contribute the beginnings of an answer to the enigmatic question: Why is our world composed of particles with such different masses?

Requiring them to resort to powerful superconducting magnets (already perfected), the LHC will take its place in CERN's big circular tunnel above the present ring of the LEP—hence its relatively low cost.

The American SSC (Superconducting Super Collider)—also a proton-proton collider, but 87 km in circumference—project would, on the other hand, cost at least \$11 billion, according to the current estimates (as against \$8 billion in 1990), and is giving rise to increasingly more criticism in the political world. After being turned down by the House of Representatives, the requests for appropriations made for its construction during the next fiscal year might also be rejected by the Senate early next week.

Its abandonment would be a catastrophe for Mr. Smith. The influx of American physicists into CERN noted these past few years might further increase and pose additional problems, specifically making it necessary to discuss American participation in its financing. Problems which CERN, with a shrinking budget that may give rise to a reduction of its personnel (from 3,000 to 2,000 between now and the year 2000), would like to avoid.

CERN would continue to be what it has been for more than 10 years, the foremost high energy physics laboratory in the world. But then, the physicists underline the fact—how will the discoveries the LHC will make be verified?

France-Germany: Gamma Ray Spectrometer Developed for Nuclear Reactor

94WS0058C Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 11 Oct 93 p 10

[Text] Gamma ray spectrometers with germanium detectors are suited to the measurement of gamma radiation in connection with nuclear power plant accidents since they permit identification of the radiating elements because of their high degree of measuring accuracy. In collaboration with the French firm, Intertechnique, and the Juelich Research Center, the University of Cologne's Institute for Nuclear Physics (Prof. Peter von Brentano and Dr. Juergen Ebert, Zulpicher Strasse 77, 5000 Cologne 41) has developed an encapsulated germanium detector for the European gamma ray spectrometer, Euroball (see also BLICK DURCH DIE WIRTSCHAFT, 28 April 1993). Encapsulated germanium detectors have applications in environmental protection and radiation protection, quality control, and space. To register gamma radiation as completely as possible, the samples should be surrounded by many detectors arranged in a sphere. But the high cost of the measuring instruments does not permit them to develop bigger detector systems for particle accelerators at individual research institutes, the experts say. This is why 30 institutes joined forces to jointly develop the biggest European gamma ray spectrometer with about 100 transportable modular detectors. In the last phase of development the spectrometer is equipped with 15 cluster detectors, each of which consists of seven individual encapsulated germanium detectors arranged in a hexagon. The photo shows a single detector with a measuring system on the right and the cluster detector composed of seven encapsulated detectors in the background.

French Company to Become Largest Worldwide Mox Manufacturer by 1996

937H S0578C Frankfurt/Main FRANKFURTER
ZEITUNG/BLICK DURCH DIE WIRTSCHAFT
in German 23 Jul 93 p 10

[Unsigned article: "Beginning in 1996 France Will Become the World's Largest Mox Producer. Economic Use of Plutonium Waste. France, Great Britain and Japan Advocate Such Processing"]

[Text] Beginning in 1996 France will become the world's largest manufacturer of the nuclear fuel Mox, which consists of 7% plutonium oxide and 93% uranium oxide 238 (unenriched). This substance, obtained from the processing of the classical nuclear fuels used in water-moderated water-cooled reactors in which uranium oxide enriched to 3.5 or 4.5% is used, will come from the gigantic La Hague atomic waste facility in Normandy. The Compagnie generale des matieres nucleaires (Cogema), which will build and operate these processing facilities, has erected a Mox production plant at a cost of 1.5 billion francs in the Marcoule nuclear research center near Avignon in the lower Rhone valley. This plant, named Melox, is as good as finished. Putting the plant into operation, which involves very high security, environmental and other outlays, will, however, still take about 1 1/2 years more. Cogema and the Framatome S.A. reactor construction enterprise will jointly operate the Melox plant, whose Mox production should amount to approximately 50 tons in the initial year 1995, but a year later the highest capacity of 115 tons will be attained. With the initiation of plant operation Cogema can use for Mox production a large part of the environment-damaging and site-polluting plutonium waste which accumulates in the processing of classical nuclear fuel. This application is proving to be all the more necessary and pressing both for a plutonium-fed nuclear power plant of the fast breeder type, like the Superphenix industrial prototype near Creys-Malville in the Rhone valley upstream from Lyon, which has stood idle for two years after several interruptions, and the considerably lower-efficiency German research breeder in Kalkar, never put into operation, which for several decades probably will unquestionably be a successor of the present-day generation of reactors. The use of Mox as a fuel for a nuclear power plant should simplify the difficulties which arise in the final phase of processing and disposal of radioactive nuclear wastes. Whereas certain countries like Sweden and the United States leave nuclear waste in this condition, France, Great Britain and Japan are leading the way with processing. With its large La Hague facility, whose production capacity is 1200 tons, Cogema now is realizing yearly sales of eight billion francs, of which nearly 55% is due to orders from foreign nuclear power plants. The supply of plutonium and unenriched uranium from the ongoing processing work at the La Hague plant for the manufacture of Mox is in the future of great economic interest for Cogema. The sale price of Mox, in comparison with that for classical nuclear fuels, to a high degree covers the manufacturing costs. The world production of Mox is presently limited to 85 tons yearly. Thirty-five tons are manufactured by Siemens AG in a plant at Hanau and the same amount by the Belgonucleaire enterprise in a plant at Dessel. Cogema itself for some time has operated a small production facility at Cadarache in the lower Rhone valley, which produces 15 tons of Mox annually. At a plant planned for Sellafield Great Britain will produce 120 tons of Mox annually prior to the year 2000 and Japan at that point in time will produce about a hundred tons.

SUPERCONDUCTIVITY

France: Alloy Becomes Superconducting at Minus 123 Degrees Celsius

BR1511143593 Paris *ELECTRONIQUE INTERNATIONAL* IEBDO in French 7 Oct 93 p 3

[Unattributed article: "New Temperature Record: Superconductivity at Minus 123 Degrees Centigrade"]

[Text] A team from the Grenoble CNRS [National Center for Scientific Research] has just beaten a new record in terms of superconductivity. Up until now, temperatures had to be reduced to minus 168 degrees centigrade to remove the resistance to the passage of an electrical current in alloys (the definition of superconductivity). Now a temperature of minus 123 degrees is sufficient to achieve this state with a mercury, barium, calcium, copper, and oxygen based alloy. However, to achieve superconductivity at minus 123 degrees, this alloy must also be subjected to 235 kilobars of pressure.

Because of this level of pressure (about 235,000 higher than atmospheric pressure), the alloy developed by the CNRS is not yet directly usable in an industrial application. However, by modifying its chemical composition, the CNRS team intends reproducing the "dense" chemical structure obtained by exerting mechanical pressure and to obtain in this way a superconducting alloy at atmospheric pressure. This will strengthen the potential of industrial electronics applications in the field of sensors, computers, and radar systems.

Germany: Research in Superconductor Applications Surveyed

94WS0064A Munich *TOP BUSINESS* in German Nov 93, pp 124-133

[Article by Thomas Finn]

[Excerpts] **Superconductors: Taming of the Shrew** Never before was a physical phenomenon so quickly adapted for concrete applications as in the case of ceramic superconductors. Most active in this field are U.S. companies

The news hit HTSC (high-temperature superconductor) specialists like a bomb shell: several months ago the Hoechst Corporation in Frankfurt, leading processor of raw materials and semi-products for nonresistive energy transmitters, announced a joint venture with the American Superconductor Corporation (ASC) in Watertown, Mass.

There are two reasons for the excitement. Firstly, the HTSC community expected an all-German purposeful alliance between Hoechst and Siemens. For until recently the laboratory models produced by this electric giant in Munich put it in a not at all bad position as candidate for such an alliance. However, the Siemens engineers preferred to get busy with optimization of current conductors at a time when competitors were proposing already usable prototypes of superconducting cables.

Billion-Volume Market of Tomorrow

There is an endless number of possible applications for high-temperature superconductors in ship propulsion, generators, maglev (magnetic-levitation) trains, super-high-speed computers, and fusion reactors. To experts like Klaus Boemken of the VDI (Verein Deutscher Ingenieure = Society of German Engineers) Technology Center it is obvious that "billions-volume markets will open up once the materials are successfully brought under control." The Federal Ministry of Research anticipates such market volumes by the year 2000 already.

The Ministry of Research in Bonn, which supports superconductor development with 320 million DM, will from now on approach this matter in a more goal-oriented manner. Applicants will receive money only if they can present functioning demonstration samples. The Federal Ministry of Research and Technology has recognized that papers alone do not open any market.

German Peak Capabilities

Even with poorly coordinated advancement, individual top achievements indicate that German researchers and developers can not only hold their own but also lead in the global technological competition.

Hoechst is an example: With a patented process making it possible to produce rods, tubes, and hollow cylinders from liquid ceramic melt, this chemical giant has profited as leading supplier of semi-products. "Here we have reached the top position internationally," says Helmut Eckhardt, director of Hoechst HTSC development.

His active team has also no problems in selling the desired ceramics. A customer for Hoechst hollow cylinder is, for instance, the Asea Brown Boveri (ABB). This electric corporation intends to use them in top-notch fuses for high-voltage networks, fuses which will prevent major damage due to short circuits or lightning strokes and protect a network against overloads.

In such a fuse the superconducting cylinder surrounds the core of the switch, namely the iron core of its choke, and shields the latter from the magnetic field of the current in the normal-metal winding. When a short circuit occurs, the cylinder abruptly loses its superconductivity and thus also its shielding effectiveness as soon as that current exceeds the critical level. The resistance of the iron core then rises and the fault current is limited to a safe level.

Such fuses function not only more reliably than conventional sensor-controlled air-blast circuit breakers but also reclose automatically after the short circuit has been cleared. "No mechanic must be sent out to splice the cable back together after the bang," says Roland Fischer, director of Thin-Film Technology at the Daimler-Benz AG (Aktien Gesellschaft = Corporation), whose AEG (Allgemeine Elektrizitaet Gesellschaft = General Electric Company) subsidiary is also working on this new technology.

The demand for nondestructible fuses is enormous. This is so because today electric networks are being protected

either by means of explosive charges which tear the conductors apart when a lightning stroke or short circuit occurs, or by installation of oversized generators, cables, and mounting supports so as to ensure adequate peak-current withstanding capacity.

High-Sensitivity Sensors

How soon HTSC current limiters will appear on the market depends on when sufficiently large hollow cylinders, single-crystal ones if possible, of that obstinate oxide material can be produced. Cylinders 20 cm in diameter could already be delivered by Hoechst developer Eckhardt. "We are now aiming at twice as large ones," he says. In only three to four years, he estimates, will a commercial market develop for them.

Another application, namely deposition of thin superconductor films on silicon wafers, is considered by Daimler developers in similar time frames. The only micrometers thick layers are, like chips, structured by photolithography and etching. This process yields sensors which, owing to their nonresistive material, are most sensitive. This too is an area in which "we are leading" emphasizes Bernhard Thomas, director of the Daimler-Benz Competence Center for Solid-State Electronics.

At this time the Daimler team has mounted into the visor a so-called chirp filter. Such HTSC-based sensors will be able to detect, among others, the presence of atmospheric chemicals in outer space: especially ozone and chlorine compounds, even when their concentrations are only a few parts per million. The bandwidth of chirp filters needed for this purpose, namely 3 MHz, is realizable only with lossless and thus highly sensitive superconductors.

Strategic Lever

While the piece count of such sensors so produced will naturally remain small and hardly sufficient for yielding a return on investment, HTSC filters for Aero-Space flight acquire a strategic significance. At stake here is not how much money should be earned but that "who does not master this field in the future will lose the entire business" believes the materials specialist Thomas.

This statement applies to sensors generally, just as much to development of most sensitive HTSC antennas by Prof Heinz Chaloupka's research team in Wuppertal as to development of magnetic-field sensors by the Research Company for Information Technology (FIT) in Bad Salzdetfurth for space flight. Both enjoyed international success: Chaloupka's receiver antennas were at the beginning of this year approved as the sole foreign-made device for the American Space Flight Experiment and the FIT sensor was carried by the "Discovery" spacecraft during lift-off from Cape Canaveral in July.

Deep-Cooled Superconductor Chips

And even the Siemens Corporation, which missed on the timely up-scaling of superconducting wires, can boast of an HTSC racer: "With SQUID sensors we now hold the world record in sensitivity" proudly pronounces the Siemens developer Eckardt. Heening. SQUIDS are used for

measuring ultraweak currents and magnetic fields as in the medical field, typically, for which only helium-cooled metallic superconductors have been available till now. Already dominant in the field with apparatus for imaging the entire human organism (tomographs), Siemens will as soon as next year widen its edge over others with an HTSC version.

TELECOMMUNICATIONS

EC: Italy's Alenia Spazio to Develop Artemis Satellite

94WS0041C Paris LE FIGARO in French 5 Oct 93
p 13

[Article by Jean-Paul Croize: "Green Light for the Artemis Satellite; The Laser Way for Telecommunications"—first paragraph is LE FIGARO introduction]

[Text] It is a matter of testing, in space, an optical transmission system that is supposed to be superior to present instruments. Its manufacturers, with an Italian company as prime contractor, expect to launch it at the end of 1996.

In Rome, this morning, Jean-Marie Luton, general director of the European Space Agency (ESA), signed a three billion francs [Fr] contract with the Alenia Spazio company; by doing so, he entrusted to Italy the future of the entire space communications technology that the Old Continent intends to develop until the end of the century. In fact, this contract, the first of such a scope to have Italy as prime contractor, covers the construction of the experimental Artemis satellite scheduled to be launched into orbit at the end of 1996 in order to test new transmission modes—especially through laser beams—between space and Earth, and between satellites or with other orbital infrastructures.

With a takeoff weight of 2,600 kg and a 10-year scheduled service life, this satellite will be worth its weight in gold; it will be a genuine "technological jewel," and its launching will be entrusted to the first unit of the future Ariane-5 currently under development (a proof of the faith placed in this future launcher). With Alenia Spazio as a prime contractor in charge of both development and construction of the satellite, the Artemis program will actually involve a total of 70 European companies, each making some of the subsystems of the first three main experiments covered by the project.

The first experiment, named "LLM", will aim to evaluate the most efficient frequencies in the range used to relay communications between land mobiles through space, throughout the European continent. According to experts, this is the telecommunication field most likely to experience a boom during the next decade. This could occur during a first stage, by enabling companies to broadcast data to trucks or cars on the road, something that Artemis will do by reinforcing the surface networks already set up by several EC countries; or, later on, by enabling each of us to use our pocket telephones absolutely anywhere.

The second objective of the Artemis program is to lay the foundations of an inter-orbital relay network similar to the TDRS [tracking and data-relay satellites] operated by NASA in the United States. Such a system, set in geostationary orbit, will help the ESA to better manage communications between ground control centers and its space infrastructures: at first, by speeding up data collection from its various satellites (especially environment study satellites); then, in 10 years or so, by monitoring continuously its manned spacecraft, using only three satellites in geostationary orbits instead of some 10 ground stations.

Very High Throughput

Finally, the development of this satellite will also enable the European space industry to make considerable innovations in the telecommunications field by testing for the first time the concept of optical transmission in orbit, between satellites. Contrary to what one might assume, this will not be a space version of the optical telegraph devised by Chappe two hundred years ago, but a vast program designed to evaluate the potential of very-high-speed data transmission (50 million of elementary data per second) through laser beams. Named Silex, this program is carried out under French-British leadership by the Matra-Marconi Space company, which has developed two transceivers. One of them will be placed on board the future Spot-4 remote-sensing satellite; it will transmit optically-coded Earth-observation data to the Artemis satellite, which will then forward them instantly to ground stations.

In addition, Artemis being a technological satellite through and through, it will also enable the ESA to test the efficiency of a new type of ionic propulsion unit for orbital maneuvers, and a new type of nickel-hydrogen batteries with increased electric capacity for the same weight.

Progress Toward European HDTV Assessed

94WS0020 Frankfurt/Main FRANKFURTER
ALLGEMEINE in German 5 Oct 93 p T1

[Text]

From Boob Tube to Multimedia Computer

First Television Broadcasts in Digital Technology Possible by 1995/PAL Will Be Around For a While

Yesterday, planners responsible for media technology and policy in industry, broadcasting corporations and telecommunications authorities were still fighting publicly over new television standards. Today, leading authorities declare without further ado that the debate is over: "If one wants to draw an apt comparison," summarizes Helmut Stein, vice president of the Finnish consumer electronics group Nokia, "then this discussion is like a public argument over future printing methods for newspapers and magazines. Such problems may indeed be interesting for insiders—but to the reader they are all more or less the same." The comparison is a little lame—like any bold analogy. For the introduction of new technologies implies decisions on distribution capacity, on future ranges of service, and definitely also on content.

The attempted withdrawal from the headlines has, after all, very obvious grounds. The next generation of television standards will function digitally. The technical basis for this is enormously complicated, and Europe, at least, is still rather far from a standardized broadcasting system. Broad-based public discussion at this time can easily lead to hopeless confusion. Nevertheless, a few important lines of development are already apparent today.

The original starting point for all large-scale television engineering projects was the desire to improve picture quality: Under the heading High Definition Television (HDTV), the picture format was supposed to be enlarged to an aspect ratio of 16:9, and scanning lines were to be doubled in order to achieve near-movie quality. On this basis, regular broadcasting of programs was begun in Japan as early as 1990 using the half analog, half digital HDTV transmission standard MUSE. Nippon's sons would have liked to push through their system as the world standard. But they were denied this export success: In the meantime, the Europeans had laid down their own HDTV transmission standard, called HD-MAC. In only four years the process, also half analog and half digital, progressed to system maturity, and in 1992 it successfully passed the general test at the Olympic Games in Barcelona.

But the fate of HD-MAC is already sealed: It is becoming a standard for the technology museum. For in the interim, the Americans have come on the scene. From the beginning, they bet on purely digital transmission systems which offer substantially more flexible possibilities for utilization. As early as 1988, there were already twenty-one proposed systems for digital HDTV before the American regulatory agency, the FCC. By the beginning of this year, they were reduced to four versions, produced by ten groups from the television, computer, and telecommunications industries. These consortia merged on May 24 of this year to form a "Grand Alliance" in order to accelerate progress of the national standard.

A few details of the four proposals show that the originally planned improvement in the picture accounts for only one aspect of the digital revolution. Only two systems emphasize doubling the lines. The other two are based on transmission of 787.5 lines and frame scanning. With this technique, the television system would be compatible with the computer and multimedia world. Notebook computers with built-in television tuners are already available in the United States. Where the television becomes a data processing machine, the classic computer assumes television and video functions. John Sculley, head of the computer manufacturer Apple, is already estimating future media scenarios at cash value: "Through the fusion of the computer, telecommunications, consumer electronics, multimedia, film, publishing, and broadcasting industries, a \$3.5 billion market will arise by the end of this century."

The American digital champions, however, are not only dreaming of completely new video and multimedia services broadcast over television channels. They can also show how transmission costs can be drastically reduced and

available television channels marvelously increased with the new technique. With the aid of data reduction methods, the frequency bandwidth required for standard quality pictures can be reduced to a fraction. In this way, a traditional television channel can broadcast four or five programs simultaneously. This aspect is of great importance for the regionally structured American television system, in which local broadcasters often have only one or two terrestrial transmitters at their disposal. European media planners were also quickly fascinated by such prospects. And if the engineers in the Old World are now feverishly seeking access to digital development, they no longer do so under the old premises. "The goal of greater program variety is winning the upper hand, at least temporarily, over the original approach of improving picture quality," says Philips manager Cornelis Bossers, chairman of the HDTV Platform Deutschland, commenting on the shift in emphasis.

Will we then have 100 or even 150 television programs to choose from in the future? For critical media observers, this would be a vision of horror rather than a desirable advance. However, it is clear that the number of classic full programs will not substantially increase in the future—at least for reasons of fundability. Yet, the considerable reduction in transmission costs linked with digital technology creates the basis for completely new media scenarios. In the future, a broad spectrum of spartan programming which manages economically with relatively low viewing figures is conceivable. Access to the medium of television could also open up for smaller local programmers. With the new transmission capacities, types of service which no longer have much to do with television in the usual sense will also become established. Based on the principles of "video on demand" and "pay per view," the videothek is coming into the living room. One can study how it functions in American models: Special video channels offer their software round the clock—beginning, for instance, in 30-minute intervals. Payment for each film viewed is made with the aid of a chip card. It is inserted into the decoder box and the electronic account registers the process on the debit side.

Of course, the digital television revolution places immense demands on technology. It should—as uniformly as possible throughout Europe—be equally suitable for satellite, cable, and terrestrial antenna distribution. And it should support high-resolution wide-area screens as well as standard TVs or mobile portable receivers which receive with a rod antenna. In order to bring all these goals under one roof and to arrive at "common standards for digital television in Europe within only a few years," a European Launching Group formed in 1992, a committee which now includes 80 companies, scientific institutions and telecommunications authorities from twelve countries. A preliminary draft of standards could be available as early as this year, hopes Professor Reimers from the University of Braunschweig, chairman of the Working Group on Digital Television Broadcasting (DVB), a consortium member.

In results of its earlier efforts, the Working Group specified four quality levels. At the top of the hierarchy is high-resolution HDTV for wide-area screens. EDTV (Extended Definition Television) is also intended for large screens in the living room and should, in comparison to the traditional PAL system, provide higher resolution and an improved sound system. SDTV (Standard Definition Television) is comparable to the quality level of analog 625-line standards. And LDTV (Limited Definition Television) provides images with reduced line numbers to supply mini-screens in cars or in personal video sets via auxiliary antennas, for example.

In various drafts, the Working Group has already proposed how broadcasting of programs for different quality requirements can be combined. All are based on a "multi-layer" design of several nested levels. A broad-band satellite or cable channel can, for example, be used for an HDTV program, which can also be decoded by EDTV receivers. In addition, another EDTV program would still fit into the available frequency spectrum. The same channel could also transmit four independent EDTV or even eight SDTV programs. Terrestrial transmission methods—here the 8-megahertz-wide UHF channels would be at issue—could transport an HDTV program that could also be decoded with EDTV and SDTV receivers.

Today, no one can predict with certainty when the digital revolution will really begin. But it is certain that the Americans already want to transmit the 1996 Olympic Games in Atlanta digitally, and this date naturally exerts at least a psychological pressure on the European digital pioneers. At any rate, seven multinational groups in the Old World are already working feverishly on the development of studio equipment, modulation systems, and set designs. Thus Reimers does not rule out the possibility that the first digital test broadcasts could be transmitted via a satellite channel as early as 1995. By then, the necessary orbital infrastructure will already be circling the globe: The Astra Group plans the operational start-up of their 1E satellite, reserved for digital service, for 1995.

But sets are also a part of television, and indeed those an earthly customer can afford. They will certainly not be available in 1995. A reminder: The development of a D2-MAC chip, workable in all details and ready for large-scale production, consumed about four years. Therefore, we can confidently keep our PAL sets up to the turn of the century—perhaps even much longer.

Germany: Siemens Announces Adapter for Fas, Data Transmission

94W50058B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 8 Oct 93 p 8

[Article by K.T.: "Fax and Data Over D Network: Siemens Adapter Is Size of Pack of Cigarettes"]

[Text] Munich—The transmission of fax signals and computer data using the GSM [global system for mobile communications] standard—in this country D1 and D2—

over the digital mobile radio network is now for the first time possible with the Siemens data service adapter (DSA). Up to now, it was used only in the analog C network. With the insertion of the DSA, which is the size of a pack of cigarettes, between mobile radio terminals and fax machines or laptop computers, the user has a mobile office. With data transmission (asynchronous mode)—for applications like a direct link with a computer or data bank—and fax transfers, it does not make any difference whether the connection in the conventional network is made to, for example, a regular office or to another mobile office. As far as operation is concerned, there is nothing new to be learned since the procedure is the same as the one users are accustomed to with the C network.

Depending on the make of the PC or laptop being used, the user can also do without the mobile fax and connect a combined printer-scanner in its place which reads in the documents to be transmitted and prints out those that are received. The DSA is prepared for future far-reaching applications with its rewritable flash-EPROM [electrically programmable read-only memory], which can be downloaded from any PC or laptop with the latest user software. The interfaces planned for use with it are V.24 for PCs, V.28 for level recorders with automatic recognition of speeds between 300 and 19,200 bauds, and a/b for G3 faxes. Depending on the kind of operation, power consumption ranges between 35 and 200 milliamperes and the supply voltage between 9 and 16.5 volts.

The DSA premiered at the end of September at a plenary session of the Special Mobile Group in Berlin. This organization representing 20 countries is incorporating the experience acquired worldwide with GSM mobile radio networks into the work of standardization.

Hungary: Matav Balatel's First Switching Centers Operational

94WS0073B Budapest *COMPUTERWORLD/*
SZAMITASTECHNIKA in Hungarian 12 Oct 93
pp 1, 5

[Article by I. D.: "Balatel Corporation: First in the Country"]

[Text] Balatel Corporation, founded by MATAV [Hungarian Telecommunications Enterprise] has reached a milestone on 24 September. Attila Illes, the firm's chairman and president announced that the first phase of the project—as scheduled from the beginning—was complete, and that the related facilities were put into operation. In this first phase of the project they established telephone central stations suitable to serve all (i.e., 49) settlements within Balatel's area of operation, the zonal network between the various stages of central stations, as well as the basic and distribution networks to connect subscribers in settlements along the shores of Lake Balaton. Simultaneously they also put into operation the Siofok facilities related to the Balatel investment, financed by Matav. A test run conducted on 29 April 1993 using a real load was completed without any disturbance.

Between May and September 6,250 new subscribers were added to the already existing 6,750 subscribers. Most of these subscribers are also owners of Balatel: They invested their own funds, amounting to about 15 percent of the newly started firm's assets, in order to obtain telephone service. Actual work began in May 1992, and during the 16-month period since then 16 new technical buildings were erected, and two were remodeled. About 150 kilometers of optical cable was laid, and transmission equipment operating at a speed of 140 megabits per second was built; in addition, a central station capacity suitable to serve 24,160 subscribers was established; the local networks in settlements on the shores of Balaton are capable of satisfying more than twice the volume of the presently recognized needs. Fifty new public telephones were installed to satisfy the most urgent needs.

A local network to serve subscribers in the interior of Somogy County, farther from the lake shore, will be built in the second phase of the project; more than 1,200 new subscribers are expected to be connected as a result. Upon completion of the second phase, the entire area covered by Balatel will have automated service. Along the shores of Lake Balaton line installation for new subscribers who have requested service in 1993 has already begun. The corporation is expected to reach its goal of being able to provide telephone service to 90 percent of new subscribers in a matter of a few weeks, by next spring.

In the present era of development, this is the first time that a telephone company successfully placed into operation a large number of subscriber lines. (The local switching center at Nagykovacs provides only about 1,000 telephone lines.) MATAV vice chairman and president Peter Tolosi (who in his previous capacity as the director at Pecs had actively participated in establishing Balatel) justifiably said that Balatel provides an example of what a local telephone company is able to accomplish in advancing regional development.

Balatel was originally meant to be a turnkey operation ["corporation"], i.e., it was not meant to provide telephone service. Despite this, Balatel continues to have a great latitude after completing the "big jobs," according to Attila Illes. Until the system is saturated, providing lines for the continuous flow of new applicants represents a substantial source of revenues (as well as work). To supplement this work, Balatel is also engaged in retailing telephone equipment. They are searching for ways in which the network could be used more efficiently, and do not rule out the possibility of leasing the network to other service providers. Negotiations are at an advanced stage with respect to property security services and cable television. Further opportunities exist in providing increased value services without concessionary agreements, i.e., as main contractors making use of the know-how acquired in the course of the project.

The Cost of Various Things

The value of the complete network financed by Balatel amounts to almost 1.5 billion forints. This does not include the worth of the Siofok central station, of the

remaining AR central station at Tab. as well as of the already existing parts of the network and sub-structures in good condition that were integrated with the new network. These are owned by MATAV. The costs financed by Balatel only, break down as follows:

- switching technology: 19.4 percent;
- transmission technology: 9.8 percent;
- long-distance networks: 6.6 percent;
- local networks: 54.3 percent;
- buildings and climate control: 2.2 percent;
- electric power: 1.7 percent;
- all other costs: 6.0 percent. The presently operational central stations have a 24,160 line total capacity, and the network is capable of accommodating 33,000 subscribers without additional construction. The average cost of establishing a subscriber station is about 65,000 forints.

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